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An Unscrambled Organization

AT VARIOUS times within the past two months the Editor has tried to keep the friends of CHEMICAL & METALLURGICAL ENGINEERING in touch with the unfortunate situation arising from the pressmen's strike. For a month no effort was made to resume publication; then when active measures were taken to print despite the radicals the problem of "unscrambling" our highly organized departments would knit the brows of a Standard Oil lawyer. Our readers cannot perhaps appreciate the almost insurmountable difficulties which on the surface appear only as a rather erratic date of issue. Although held by the Post Office to consecutive page numbering and to back-dating the issue, it is important to note that the news pages in each issue are made up but a few days before it reaches your hand.

A Scotch Professor and The Control of Research

IN AN address before the Mathematical and Physical Science Section of the British Association for the Advancement of Science, at its recent Bournemouth meeting, Professor A. GRAY spoke his mind with some fervor in regard to several things, but first about the lack of scientific training among men in authority and influence. Among the instances in which he found crass ignorance in place of the anticipated open minds, he mentioned the following: A very eminent lawyer declared that one of NEWTON'S laws of motion was that "friction is the cause of oscillations." In a discussion on the Forestry bill in the House of Lords a member of that noble body asserted that forestry had nothing to do with science; all that was needed was to dig holes and stick young trees into them. Of the committee which is to manage and foster the dye industry of Great Britain the supermen in control have refused to allow any man of scientific eminence to become a member—and this in spite of remonstrance. He heard a leading statesman assert that an electrical efficiency of 98 per cent might, by progress of electrical science, be increased fourfold.

This sounds almost familiar. It would not be hard to find American instances to match them. It does beat all how unashamed men are of ignorance of science, while almost anyone would blush to be unfamiliar of the legend of the heel of ACHILLES.

These instances were given by way of introduction to the Scottish professor's comments on centralization of scientific effort, and his doubts as to the unfailing wisdom of a High Commission sitting in London to direct it. He held direction by a central body in London to be warranted for work for which the funds may be obtained in London, but he protested that local incentives are not easily moved. He could not see the wisdom of giving charge of special research scholarships in all English and Scottish universities to a metropolitan bureau. "I observed," he added, "with some amazement, that, according to the proposals of one committee for applied science, which is prepared to give grants and premiums for researches and results, the professor or head of the department from whom will generally come what are most important, the ideas, is to have no payment—and the results are to be the property of the Committee!"

He fears too much control of research. He calls to mind the tremendous series of results in electricity of which the beginning was FARADAY'S and HENRY'S work on the induction of currents, and the conclusion which was the work of HERZ on electric waves. He doubts if these men would have received grants for their work from a body of good business men, and yet they were the pioneers of industry. He made an earnest plea for independence of research, especially in pure science, on the ground that control defeats its own purpose.

We have great confidence in the research organizations that have been established in this country, the need of which was made manifest by the war. But we think it well to bear in mind the hazards of centralization. Many of us can recall the launching of trusts in business fifteen or twenty years ago, and the cheerful hopes which were entertained that, by central control, the elimination of unnecessary sales forces, and the specialization of work, the optimistic and vast body of mortals let in on the ground floor of each establishment were to grow rich. Those were days of glorious dreams—but only a few of them came true.

The head of a research organization must be easy and gentle and kindly, lest he destroy initiative.

Initiative is as evanescent as good will, and at the first sign of bumptiousness or vanity or offensiveness it flies out of the window. System and order and economy are all excellent in their way, but in research the most needful thing is the right man at the head.

Lessons From the Industrial Conference

RAISING a point of order on the hour of adjournment saved the President's Industrial Conference from disintegration twice during the second week of its deliberations at Washington. The steel strike resolution introduced by the Labor Group, calling on the Conference to appoint six of its members to adjudicate the strike, proved to be the rock on which the assembly was almost shipwrecked. And a wreck surely would have ensued if the Labor sponsors of the resolution had allowed the Conference to vote on the measure. Instead, they resorted to the rules and forced adjournment because the agreed hour had been reached and passed, just as a vote was about to be taken.

But the remainder of the week was not turned to any better advantage. Instead of following the sound advice of JOHN SPARGO—that the Conference should first receive all the resolutions to be offered, then classify them, and finally proceed to their consideration in an orderly manner—it was decided to abandon temporarily any consideration of the steel strike resolution, and to direct the General Committee to bring in within 24 hours a proposal on the vital subject of collective bargaining! Obviously this was a difficult task, because the Conference had not even considered the subject in debate.

The result was that a resolution evolved under strain and pressure was brought in and debated for several days without effect. And after one or two substitutes had been offered, and a parliamentary situation created thereby, a vote was about to be reached when the rules were again invoked to force adjournment. The vote plainly would have defeated the measure and the Conference would have gone to pieces. Thus twice in one week parliamentary tactics prevented disintegration!

It is now quite evident that if any Conference is to accomplish the purpose for which it was called, a different procedure will have to be adopted. There are certain fundamental questions in industrial relations that all of the population must agree upon if possible. These fundamentals comprise a platform which industry would welcome for its guidance. It is useless to quibble over details and particulars as long as fundamental principles are unstated, and it is to be hoped that new tactics will be adopted.

There are many plans for industrial representation or industrial democracy in existence and operation throughout the country. These should be studied and published. Some harmonious pronouncement should be sought on such subjects as production, wages, hours of labor, women and children in industry, collective bargaining, mediation and arbitration, the role of management, provision against unemployment, industrial conference boards, open and closed shops, the conduct of strikes and lockouts, the nature of public and private service, training of workers, and other phases of industrial relations. If the new Conference can do something of this kind the country will look to it for guidance and untold good can come from its deliberations. Nothing short of this can be considered a satisfactory outcome. And nothing short of this will be effective in clearing the national thought on our industrial situation, and enable the country to combat successfully the economic fallacies that are being preached by the radicals.

A New Function for Our Engineers Abroad

IN YEARS gone by the usefulness of an engineer in backward portions of the earth possessing great natural resources was limited to a large extent. Whatever his former familiarity with most modern mechanical equipment and his natural prepossessions in its favor, he soon found when figuring his own specific problems that owing to the extremely low cost of human labor it was impossible to effect any money saving by the use of even the most highly developed mechanical appliances—often they would hardly be able to compete with hand labor in net operating expense, without allowing anything for capital charges and depreciation. This was particularly true about the handling of materials. Laborers were hired from the surrounding country, they brought along their own horses and carts—and the whole problem of getting huge quantities of materials from one place to another was solved, and at a price which would make a steam shovel contractor with his automatic dump cars envious.

Consequently, the engineer soon found that his function was largely the management of a concern run by man-power rather than the designing of labor-saving methods of doing the work. Labor was too cheap to save!

But revolutionary conditions in northern Europe and Asia, at least, have changed all this. As pointed out recently by ROBERT S. BOTSFORD, an American mining engineer just returned from Petrograd after seven years in Russia and Siberia, labor costs have risen to ten times their former level, what with increased wages and decreased willingness. It is therefore obvious that a revolutionary change has come over the relation between mechanical equipment and "main strength and awkwardness," and with this new relation appears a change in the proper status of the engineer. It is certain that there is to be a tremendous demand from established industries in these regions, as soon as their governments are stabilized and can inspire confidence, not only for labor-saving machinery, but also for brains to install it to best advantage and keep it running after it is installed.

Readers' Views and Comments

Sulphuric Acid Nomenclature

To the Editor of Chemical & Metallurgical Engineering

SIR:—I quote a few sentences from the article "Calculation of Hydrometer Degrees, Gravities and Weights With the Slide Rule," by Wallace Savage, appearing in your Sept. 15 issue:

"Without doubt there is much virtue in the simple integer 'degree' scales. For instance, take 66 deg. Baumé oil of vitriol. Who would prefer to memorize 1.8354 sp.gr. or try to teach it to acid plant workmen? No doubt the per cent hydrometer is the instrument of the future. However, some substances such as sulphuric acid do not lend themselves well to this type of instrument."

I agree that sulphuric acid with its present general use of all terms of its nomenclature would not lend itself well towards this type of instrument. But why not use one general per cent term, thus making it more possible and practical to use it?

Going back to the nomenclature, we have all strengths up to 93.19 per cent H_2SO_4 termed as so many degrees Baumé. The term oil of vitriol is often misquoted in that it refers to 66 deg. acid only. From 93.19 per cent to 100 per cent H_2SO_4 acid is termed as so many per cent in terms of H_2SO_4. From 100 per cent on we have fuming sulphuric or oleum. Here we have more confusion. As a specific case take 20 per cent fuming or oleum. This strength has an actual H_2SO_4 content of 80 per cent and is generally referred to as 20 per cent, 85.3 per cent or 104.5 per cent. Twenty per cent is the per cent of free or uncombined SO_3, 85.3 the total per cent SO_3 and 104.5 the equivalent per cent 100 per cent H_2SO_4 it would produce if sufficient water were added to combine with all of the free or uncombined SO_3.

Why all of this confusion in terms? If anyone doubts that confusion actually exists let him try explaining the whole to a person unfamiliar with sulphuric acid nomenclature. Why not simplify matters and refer to all strengths up to fuming as per cent H_2SO_4 and from there on as equivalent per cent H_2SO_4? For instance take the more common grades and express them in terms of H_2SO_4:

60 deg. B. sulphuric acid	=	77.67 per cent H_2SO_4
66 deg. B. sulphuric acid	=	93.19 per cent H_2SO_4
Oil of vitriol	=	93.19 per cent H_2SO_4
98 per cent sulphuric acid	=	98.00 per cent H_2SO_4
Monohydrate sulphuric acid	=	100.00 per cent H_2SO_4
20 per cent fuming sulphuric acid	=	104.50 per cent H_2SO_4
85.3 per cent fuming sulphuric acid	=	104.50 per cent H_2SO_4
104.5 per cent fuming sulphuric acid	=	104.50 per cent H_2SO_4
20 per cent oleum	=	104.50 per cent H_2SO_4
85.3 per cent oleum	=	104.50 per cent H_2SO_4
104.5 per cent oleum	=	104.50 per cent H_2SO_4

Simplicity would be gained for every one concerned by the use of one general term. Tables could be very easily revised to even percentages to avoid having common grades read in decimals. Producers marketing 60 deg. B. acid could change to 78 per cent, 66 deg. B. to 93 per cent, etc.

More confusion would be eliminated by reporting acid tonnages as tons H_2SO_4 rather than converting all to a meaningless 50 deg. B. basis.

Depue, Illinois. THOMAS J. SULLIVAN.

Recording Pyrometry

To the Editor of Chemical & Metallurgical Engineering

SIR:—In the September Bulletin of the American Institute of Mining & Metallurgical Engineers, there is an advanced printing of the paper entitled "Recording Pyrometry," by C. O. Fairchild and Paul D. Foote of the Bureau of Standards, wherein, on page 1646, where some details in description of our multiple recorder, the Tapalog, are given, the following statement appears:

"Consistent with the sturdy construction of other parts, the galvanometer is not made with a high resistance (only 10 to 50 ohms) and when the recorder is installed, the thermocouple circuits must be carefully made and lead resistance of definite value used."

The conclusions stated in this paragraph are drawn from the erroneous resistance values specified. With a wrong premise a wrong conclusion naturally results. Actually, the internal resistance of the Tapalog, instead of being from 10 to 50 ohms, is from 100 to 450 ohms, so that it is evident that the Tapalog is made with a high-resistance galvanometer and the thermocouple circuits do not have to be adjusted to give very definite lead resistances. Even back in 1914 and 1915, the average internal resistance of the Tapalog was running from 80 to 105 ohms, and the Tapalog neither now nor when it was first on the market has ever been equipped with low-resistance galvanometers, as indicated in the article referred to.

This statement quite unintentionally, we are assured and satisfied, greatly misrepresents one of the first high-grade pyrometer recorders developed in this country and an instrument that was called upon to do much important service in many of the arsenals and armories during the war. The authors have since made every effort to have the misstatement rectified. However, they recognize the fact that they personally are unable to set the matter right except to those who attended the recent Chicago meeting of the Mining & Metallurgical Engineers, and I would request a little of your space to correct the statement in the minds of others who have read the original paper.

WILSON-LAEULEN CO.,
By C. H. Wilson, President.

New York City.

A new mathematical journal called *Die Matematische Zeitschrift* has been launched in Berlin. It is edited by Professor L. Lichtenstein, with a group of associates. Two volumes will appear per year.

Western Chemical and Metallurgical Field

Metallurgical Plan for Consolidated Coppermines

THE solution of a problem in metallurgical engineering is not always clear cut; certain contingencies are usually to be met in the premises and the little word "if" is often inserted. Usually, also, the present-day problems and the more complex ores require a large amount of research and comparatively large-scale operations before the metallurgist is warranted in drawing definite conclusions or in making specific recommendations. The annual report of the Consolidated Coppermines Co. for the year ended April 30, 1919, contains a metallurgical plan for the treatment of the company's ore which is submitted by Mr. Frederick Laist, who was retained by the company as a consulting metallurgist.

In the introductory paragraphs of the report, Mr. Laist states that the responsibility for the estimates of available tonnage and grade of ore reserves, together with the estimates of the mining costs, rests with the operating company, but that he assumes responsibility for all estimates of costs of ore treatment and percentage of recovery of copper as well as all recommendations relative to ore reduction plants, on the following premises, viz.:

1. That there is available for concentration a minimum of 2000 tons per day of "porphyry" ore containing not less than 1.4 per cent of copper, practically all in form of sulphide and conforming in general to the analysis given herein.

2. That there is available for concentration about 150 tons per day of "sulphide" ore containing 2.9 per cent Cu and otherwise of approximately the analysis given herein.

3. That there is available for smelting about 150 tons per day of "oxidized" ore containing 7.5 per cent copper and otherwise of approximately the analysis given herein.

It is assumed that these ores, in the quantities and of the grades named, can be delivered to the reduction works at a cost of around $1.10 per ton for the porphyry ore, $5 per ton for the sulphide ore and $10 per ton for the oxidized ore for a period of not less than 10 years.

An increase in the daily production of porphyry ore to 4000 tons would make unnecessary the production of oxidized ore so far as the economy of the smelter operations is concerned.

An increase of the daily production of porphyry ore to 5000 tons would result in the production of sufficient concentrates from this source alone to maintain the smelter in economical operation.

Ten years' operations on the scale assumed herein will require 7,200,000 tons of porphyry ore, 540,000 tons of "sulphide" ore and 540,000 tons of "oxidized" ore.

On the basis thus set forth, it is recommended that a new concentrator having a capacity for 2000 tons of porphyry ore and 150 tons of "sulphide" ore be constructed. In connection with the concentrator there is to be constructed a power plant capable of generating 3000 kw., which will furnish sufficient power for water supply, operating concentrator, smelting and mining plants; and a reverberatory smelting plant capable of smelting the concentrates resulting from the above ore, as well as about 150 tons of "oxidized" ore per day.

The concentrator is to be constructed nominally in two sections, but is to be so arranged and provided with spare grinding mills and flotation machines that a breakdown of one of these will not affect operations. Allowance is to be made for future possible extension to 5000 tons treatment per day. The crushing plant is to be built for 3000 tons per 8 hours. The power plant is to contain two 3000 kw. turbo-generator sets for 2200 volts, 60 cycle, 3 phase. Boiler capacity is to be provided for the entire 3000 kw., but about 500 kw. will probably be obtained from the waste-heat boilers in the reverberatory plant. The boilers are to be equipped with automatic stokers or possibly for pulverized coal.

The smelting plant will consist of a drying department containing four 20-ft., 7-hearth Anaconda Wedge roasting furnaces; a smelting department containing one 100-ft. x 20-ft. coal-dust fired reverberatory furnace equipped with Stirling waste-heat boilers; and a converting department containing two 12-ft. diameter Great Falls type converters and stands.

The immediate construction of a second reverberatory furnace is recommended, although it is not absolutely needed; the smelter building should at any rate be made sufficiently long to accommodate the second furnace when it is built. This will add approximately $50,000 to the estimate and is being allowed for. The second furnace would cost about $125,000 more and is not being allowed for.

The reverberatory plant will have a capacity of 445 tons of total solid charge per day and about 50 tons per day of molten converter slag. Of this charge 133 tons will be porphyry concentrates. Assuming that the concentrator be enlarged to 5000 tons daily capacity, 200 tons more, or a total of 333 tons, of this kind of concentrate will result. This would permit of smelting about 100 tons more of "oxidized" ore, or a total of 300 tens of cuprous material, requiring, say, 65 tons more of flux and producing 25 tons more of secondaries.

Three hundred and ninety tons per day is, therefore, the total probable future requirement of the smelter, and one additional reverberatory furnace, one more converter stand and two more drying furnaces will easily take care of this increase. This plant is laid out with this possible extension in mind.

It is estimated that there will be a saving of practically 28c. per ton of ore in favor of establishing the concentrator and smelting plant at Kimberly (instead of at Ely) and pumping the water necessary for the concentrator, in spite of the fact that the water must be pumped a total height of 967 ft. or against a total head, including friction, of 1200 ft. (600 lb. per sq.in.) and a distance of 13 miles.

This saving requires no qualification, as the cost of coal for smelting and power purposes as well as supplies would be exactly the same at Kimberly as at Ely, the same freight rate being charged to both points. This would presumably also apply to shipments of copper. Fluxes could be delivered somewhat cheaper at Kimberly than at Ely.

It is obvious, therefore, that the reduction works should be located at Kimberly, since a saving of 28c. per ton represents approximately 1.2c. per pound of copper recovered from porphyry ore, or about $200,000 per year on a 2000-ton-per-day, or $500,000 per year on a 5000-ton-per-day porphyry operation.

Savings to be realized by the construction of the new

plant as compared with the method of operation pursued till the end of 1918 are given herewith.

These calculations are based on the following analyses, which are taken from the metallurgical statements of the Consolidated Coppermines Co., and represent averages over considerable periods. Recovery figures and concentration ratios are based partly on the performance of the Kimberly mill, which made a recovery of about 82 per cent during the last three months of 1918, with a concentration ratio of 17 to 1 and partly on results obtained at a research laboratory:

ANALYSIS OF PORPHYRY ORE

	% Cu	% Ag	% Au	% Insol.	% SiO_2	% Al_2O_3	% Fe	% CaO	% S
McGill plant.	1.455	0.046	0.013	....	66.1	11.9	4.4	1.1	2.8
Kimberly plant.....	1.303	0.048	0.014	87.5	....	11.8	3.5	1.9	2.5
Average.....	1.379	0.047	0.013	87.5	66.1	11.9	4.0	1.5	2.7

Assume as basis—2000 tons per day of ore averaging 1.4 per cent Cu; 85 per cent concentrator recovery; ratio of concentration 15 to 1, producing 133 tons concentrates per day.

Analysis of concentrates to be produced:

% Cu	% Ag	% Au	% Insol.	% Fe	% CaO	% S
18.0	0.475	0.189	20.0	25	1.5	27

ANALYSIS OF SULPHIDE ORE

% Cu	% Insol.	% Fe	% S
2.9	60.0	18.0	9.6

Assume as basis—150 tons per day; 90 per cent concentrator recovery; ratio of concentration 4 to 1, producing 37 tons concentrates per day.

Analysis of concentrates to be produced:

% Cu	% Insol.	% Fe	% S
10.5	15.0	32.0	34.0

Assume smelter recovery at 95 per cent, operating costs are estimated as follows:
Power—$0.01 per kw.-hr.
Concentrating—$0.85 per ton.
Drying—$0.45 per ton.
Reverberatory smelting—$2.35 per ton.
Converting and casting—$10 per ton of copper.

TOTAL SMELTING EXPENSES

Crushing 275 tons ore, flux and secondaries at 15c	$41.20
Drying and mixing 445 tons at $0.45	200.00
Reverberatory smelting 445 tons at $2.35	1,045.00
Converting 37 tons Cu at $7.50	278.00
Casting and loading 27 tons at $2.50	92.60
	$1,656.80
Add 10 per cent for miscellaneous	165.68
	$1,822.48
Cost of smelting per ton ore concentrate mixture	5.70
Cost of smelting per lb. of copper produced	0.0246
Cost of concentrating per lb. of copper produced	0.0247

SUMMARY SAVINGS IN FAVOR OF NEW PLANT

Concentrator savings and smelting charges	$1,871.00
Freight charges on concentrators	83.00
Smelting charges on "oxidized" ores, 150 tons at $4.05	608.00
Smelting charges on "sulphide" ores, 150 tons at $7.69	1,155.00
Total daily saving	$3,717.00

Or on a basis of 360 days, $1,340,000 per year.

In addition to the above there is a possibility of saving from $400 to $600 per day in refining and freight charges by furnace refining locally.

ESTIMATED COSTS AND EARNINGS

The total earnings of the plant outlined herewith can be approximated as follows:

Mining 2000 tons porphyry ore at $1.10	$2,200.00
Mining 150 tons oxidized ore at $10.00	1,500.00
Mining 150 tons sulphide ore at $5.00	750.00
Concentrating 2150 tons at $0.85	1,830.00
Smelting expenses on concentrates and ore	1,823.00
Total daily local expenses	$8,103.00
Freight to market 37 tons Cu at $16.60	615.00
Refining 37 tons at $22.00	815.00
Total cost of producing 37 tons Cu	$9,533.00
Less credit of $10.00 per ton for Au and Ag	370.00
Total net cost for 37 tons	$9,163.00

or $247.00 per ton Cu = 12.35c. per lb. Cu.*

Profit in 18c. Cu = 5.65c. per lb. or per day, $4,100.
Yearly earnings, say, $1,500,000 less selling expenses and taxes.
* It is safe to say that under pre-war conditions, the cost per lb. of copper would have figured less than 10c.

In order to realize this estimate it will be necessary to spend some money on equipment in the mining department, which has not been allowed for in the estimate.

The plant outlined herewith is of the minimum size to be recommended. Any smaller sized plant would necessitate less than standard sized units in the smelter and would considerably increase both concentrating and smelting costs. The plant, as proposed, will, on the other hand, make almost as good costs as a plant of twice the size.

The estimate of the plant cost given herewith does not include railway approaches to the smelter and concentrator. It does, however, include everything pertaining to the concentrator and smelter, including all office and shop buildings and equipment.

TREATMENT OF PORPHYRY ORES ALONE

In order to convey an idea of the value of the prophyry ores alone, without admixture of high-grade "oxidized" ore, the following estimate is submitted. The complete treatment of porphyry ore alone locally would scarcely be feasible on a scale of much less than 5000 tons per day. This quantity of ore would, however, yield approximately 300 tons of concentrates, which would make the total amount of material to be smelted, including fluxes and secondaries, about 425 tons per day, which would be an economical operation for one reverberatory furnace.

The cost of the operation would be about as follows:

Assume recovery in bullion of 80 per cent of 1.4 per cent Cu = 22.4 lb. per ton.

COST OF TREATMENT PORPHYRY ORE ALONE—5000 TONS PER DAY

	Per Lb. Cu
Mining at $1.10 per ton of ore	$0.0491
Concentrating at $0.85 per ton of ore	.0379
Smelting at $6 per ton of concentrates	.0179
Freight at $16.60 per ton copper	.0083
Refining at $22 per ton copper	.0110
Gross cost	$0.1242
Credit for gold and silver	.0050
Net cost	$0.1192

This cost is based on present cost of labor and supplies. Under conditions such as prevailed prior to the war a net cost of not more than 10c. per lb. and probably less could doubtless have been realized. The above estimate allows for reasonable miscellaneous expenses, but does not allow for selling expenses, war or excess profits taxes.

An operation as here outlined would produce about 40,000,000 lb. of copper per year, would yield, on an 18c. copper market, $2,400,000 per year less selling expenses and taxes and would require an investment of about $3,500,000 in water supply and reduction plants.

ESTIMATED COST OF REDUCTION WORKS AS OUTLINED HEREWITH

Assume daily treatment—	
Porphyry ore.....	2,000 tons
"Sulphide" ore....	150 tons
"Oxidized" ore....	150 tons

Water supply 1,000 to 1,500 gal. per min.	$305,740
Crushing plant	100,000
Concentrating plant	450,000
Power plants—3,000 kw.	450,000
Drying plant	200,000
Reverberatory plant	350,000
Converting plant	150,000
Bins, rolling stock, shops, houses and miscellaneous	300,000
	$2,305,740
Engineering, drafting and contingency (say)	194,260
Total	$2,500,000

This estimate is based on present cost of supplies and labor and is considered conservative.

The plant can be enlarged at any time, without interfering with operations, to 5000 tons of porphyry and 250 tons of oxidized ore, at an additional expense of about $1,400,000.

The President's Industrial Conference

Second Week's Meetings See Crisis Nearly Reached on the Resolution to Take Action on the Steel Strike—Collective Bargaining Another Question Bringing Out Diverse Opinions—Compromise Is Sought

DURING the second week of its deliberations the President's Industrial Conference successfully weathered two dramatic crises which threatened its disruption, and on adjournment decided to make a further attempt to accomplish its purpose of reaching "some common ground of agreement and action with regard to the future conduct of industry." The introduction of Labor's steel strike resolution accomplished all that was expected of it in the way of warm debate and argument, and finally made necessary a decision to sidetrack it temporarily while the General Committee sought to establish a fundamental principle on which both sides could agree for the settlement of all such disputes as the steel strike. In this they were not successful, for the introduction of a resolution on the subject of collective bargaining proved as contentious as the steel strike resolution, and at the end of the week the Conference was again held together only by cool counsel, but without positive accomplishment.

Conference Committed to Serve Interests of General Public

When the Conference convened Tuesday morning, Oct. 14, the Committee of Fifteen first recommended approval of Mr. Fish's resolution declaring that the issues to be considered were of interest primarily to the whole people of the country, and calling upon the delegates to consider themselves as representative of the entire community rather than of a specific group. This resolution was adopted with little debate and by the affirmative vote of a majority of each of the three groups. It was, however, the subject of ironical reference by Mr. Gompers, who spoke of "the momentous character, the all-pervading importance, the wonderful settlement of all troubles, involved in this radical resolution."

This matter disposed of, the Committee of Fifteen proceeded with its report involving the classification of the resolutions already offered. The Committee's report was adopted seriatim until the item of the steel strike was reached, and when the Labor Group recommended adoption there was an attempt to refer it back to the committee for further consideration. This was defeated, and there ensued debate on the question of whether the resolution was germane to the purposes of the Conference. Chairman Lane finally ruled that the question could be considered, whereupon Mr. Chadbourne of the Public Group offered a substitute resolution which provided for a committee of the Conference to consider and settle all pending strikes and not the steel strike alone. This substitute was finally rejected by the vote of each group, and the original resolution offered by the Labor Group to settle the steel strike was taken up.

Debate on the Steel Strike Resolution

The committee having reported the resolution without recommendation, debate was opened by Mr. Gompers. Claiming that Labor's proposal to settle the steel strike was generous, comprehensive and yielding, Mr. Gompers reviewed the negotiations of Labor with the United States Steel Corporation, and addressed himself particularly to the attitude taken by Mr. Gary, who sat in the Public Group. Every effort consistent with the humor of the laborers had been taken by their leaders, Mr. Gompers said, to postpone a strike, and it was only after he and his associates had realized fully the situation that they withdrew their objections because a strike was inevitable. He took the position that it was better for the country that the strike should be controlled and directed by organized labor than that it should fall into the hands of radical and irresponsible leaders. These latter, he said, were on the ground, anxious and willing to take charge of the strike.

The terror of Bolshevism and the fear of the radical were held out to the Conference as the alternative to acceptance of Labor's proposal as embodied in the resolution. On this point Mr. Gompers addressed himself to the Conference as follows:

"You may win this steel strike unless you consent that it shall be adjusted after the fashion that we have so liberally proposed; but if you reject that method, and the steel strike goes on and lasts a month or two or three, and drags out, and you have won, and these men go about the country preaching the doctrine of their unbearable conditions and the tyranny which they experience and the injustices which have been meted out to them, then whatever betide, you have sown the seed and will bear the consequences. You will either come to agreement with us, or you will destroy the ability of men in our movement to stand up for the right. We will be discarded as impotent or unfaithful; and if you discard us, if you decline to enter into agreements with us, you will have somebody else to deal with and you will find them arguing and appealing to you."

Following Mr. Gompers' impassioned appeal a motion was introduced and seconded to postpone consideration of the resolution for several days in order that the Conference might study the matter more

carefully. This brought protests from the Labor Group and renewed claims of the fairness of the proposal—that two men from each group should arbitrate the strike, giving Labor only two representatives in a committee of six.

The Objections of the Employers

Debate on this motion brought out the Employers' objections to the resolution as stated by Mr. Loree. The first objection was that the resolution was not germane to the purposes of the Conference and diverted its members therefrom. The second was "the wide field we will have to wander over if we permit ourselves to be diverted." Other objections were similar in character, one claiming that the Conference represented the executive branch of the Government and should not deal with legislative matters. In view of the fact that a Congressional committee was now investigating the strike, it would be unwise and futile for the Conference to undertake a similar investigation.

After further debate the motion to postpone further consideration of the resolution was put and declared lost, the Labor and Employers Groups voting against it.

The question then being upon the motion to adopt the resolution, the chairman proceeded to poll the groups for their vote, and it seemed as though final action was imminent. The resolution was read again, and when the vote of the Public Group was called for, Mr. Baruch asked for an adjournment for a short time for its consideration. The tension of the situation was apparent to all concerned and the gravity of any action was fully appreciated. But just as decision was about to be reached on Mr. Baruch's request for time to consider the question, a point of order was made by a member of the Labor Group that the time for adjournment was past and that the Conference was not legally in session. This point was held in order by the chairman, and he declared the Conference adjourned just as it seemed about to vote on the most contentious resolution yet brought before it. Labor undoubtedly realized that the resolution would be lost if a vote was taken at that time, and consequently saved itself for a time at least by taking refuge in adjourning under the rules.

Steel Strike Resolution Shelved

When the Conference convened on the following morning, Mr. Baruch of the Public Group moved "that action on the steel strike resolution be deferred until the General Committee reports on the question of collective bargaining, and that the General Committee be directed to report on this question not later than Thursday afternoon at 2:30." This motion was carried after considerable debate, and once more action on the steel strike resolution was deferred in the hope of harmonizing the different interests and finding, if possible, common ground for a majority of the Conference. Members of the Employers Group were emphatic in their protest against forced action in 24 hours, claiming that nobody could possibly arrive at a conclusion on so momentous a matter as collective bargaining in such a short time. Again it was urged that the settlement of the steel strike was not a proper subject for the Conference's consideration, but that the many proposals which had been offered should be taken up and discussed. The immediate production of a resolution on collective bargaining, without considering its relation to other matters, was declared inconsistent and unnatural. Nevertheless the motion to adjourn for 24 hours prevailed, and the business of the Conference suddenly was shifted from a consideration of the steel strike to the subject of collective bargaining.

Strange Alignment on Collective Bargaining

When the Conference again convened, the General Committee offered the following resolution on the subject of collective bargaining:

"The right of wage-earners to organize in trade and labor unions, to bargain collectively, to be represented by representatives of their own choosing in negotiations and adjustments with employers in respect to wages, hours of labor and relations and conditions of employment, is recognized.

"This must not be understood as limiting the right of any wage-earner to refrain from joining any organization or to deal directly with his employer if he so chooses."

If the steel strike resolution was contentious, and if the Conference hoped to make progress by abandoning temporarily the consideration of that subject for another, it could not have selected a less fortunate proposition than collective bargaining. Nor, as the debate proceeded, could a stranger alignment of forces have been forecast than that which found Mr. Rockefeller, capitalist, and Mr. Spargo, socialist, both members of the group representing the Public, firmly advocating the claims of the Labor Group for collective bargaining. It was early apparent, however, that these two groups, representing Labor and the Public, were in harmony on the resolution, and that the Employers were in opposition. Three hours of debate ensued and the Conference again adjourned, no nearer to agreement on collective bargaining than it was on the settlement of the steel strike.

Mr. Rockefeller on Collective Bargaining

Disclaiming any "executive position in any business corporation," Mr. Rockefeller addressed himself to the subject as "one of the representatives of the general public in this Conference." His address was replete with expressions of idealism and gave full support to the principle of representation of labor in industry, a principle which he is known to have established practically in the conduct of the Colorado Fuel & Iron Co. Parts of his address follow:

"We have been called together to consider the industrial problem. Only as each of us discharges his duties as a member of this Conference in the same high spirit of patriotism, of unselfish allegiance to

right and justice, of devotion to the principles of democracy and brotherhood with which we have approached the problems of the war, can we hope for success in the industrial problem, which is no less vital to the life of the nation.

"The world position which our country holds today is due to the wide vision of the statesman who founded these United States and to the daring and indomitable persistence of the great industrial leaders, together with the myriads of men who with faith in their leadership have co-operated to rear the marvelous industrial structure of which our country today is so justly proud.

"This result has been produced by the co-operation of the four factors in industry, labor, capital, management and the public, the last represented by the consumer and by organized government. No one of these groups can alone claim credit for what has been accomplished. Just what is the relative importance of the contribution made to the success of industry by these several factors and what their relative rewards should be are debatable questions. But however views may differ on these questions, it is clear that the common interest cannot be advanced by the effort of any one party to dominate the other, to arbitrarily dictate the terms on which alone it will co-operate, to threaten to withdraw if any attempt is made to thwart the enforcement of its will. Such a position is as un-American as it is intolerable.

"There are those who believe that legislation is the cure-all for every social, economic, political and industrial ill. Much can be done by legislation to prevent injustice and encourage right tendencies, but legislation will never solve the industrial problem. Its solution can be brought about only by the introduction of a new spirit into the relationship between the parties to industry—a spirit of justice and brotherhood.

Personal Relationship Is Needed

"The personal relationship which existed in bygone days is essential to the development of this new spirit. It must be re-established; if not in its original form, at least as nearly so as possible. In the early days of the development of industry, the employer and capital investor were frequently one. Daily contact was had between him and his employees, who were his friends and neighbors. Any questions which arose on either side were taken up at once and readily adjusted. A feeling of genuine friendliness, mutual confidence and stimulating interest in the common enterprise was the result.

"How different is the situation today. Because of the proportions which modern industry has attained, employers and employees are too often strangers to each other. Personal contact, so vital to the success of any enterprise, is practically unknown, and naturally, misunderstanding, suspicion, distrust and too often hatred have developed, bringing in their train all the industrial ills which have become far too common. Where men are strangers and have no points of contact, this is the usual outcome. On the other hand, where men meet frequently about a table, rub elbows, exchange views and discuss matters of common interest, almost invariably it happens that the vast majority of their differences quickly disappear and friendly relations are established. Much of the strife and bitterness in industrial relations results from lack of ability or willingness on the part of both labor and capital to view their common problems each from the other's point of view.

"While obviously under present conditions those who invest their capital in an industry, often numbered by the thousand, cannot have personal acquaintance with the thousands and tens of thousands of those who invest their labor, contact between these two parties in interest can and must be established, if not directly, then through their respective representatives. The resumption of such personal relations through frequent conference and current meetings, held for the consideration of matters of common interest such as terms of employment, and working and living conditions, is essential in order to restore a spirit of mutual confidence, good will and co-operation. Personal relations can be revived under modern conditions only through the adequate representation of the employees. Representation is a principle which is fundamentally just and vital to the successful conduct of industry. This is the principle upon which the democratic government of our country is founded. Surely it is not consistent for us as Americans to demand democracy in government and practice autocracy in industry.

"What can this Conference do to further the establishment of democracy in industry and lay a sure and solid foundation for the permanent development of co-operation, good will and industrial well being? To undertake to agree on the details of plans and methods is apt to lead to endless controversy without constructive result. Can we not, however, unite in the adoption of the principle of representation, and the agreement to make every effort to secure the indorsement and acceptance of this principle by all chambers of commerce, industrial and commercial bodies and all organizations of labor? Such action I feel confident would be overwhelmingly backed by public opinion and cordially approved by the Federal Government. The assurance thus given of a closer relationship between the parties to industry would further justice, promote good will and help to bridge the gulf between capital and labor."

The Case for Labor

Mr. Morrison, secretary of the American Federation of Labor and a member of the Labor Group, acted as spokesman for Labor in debating the resolution. He addressed himself first to a proposal of the Employers Group on the open shop, that "no employer should be required to deal with men or groups of men who are not his employees or chosen by and from or among them." This, of course, was the es-

sence of the Employers' anticipated opposition to the resolution on collective bargaining, and Mr. Morrison attacked it as a principle that "violates established and prevailing custom in industry in the civilized world, nullifying the good faith of all the other principles advanced in its program by the Capital Group." He then cited the custom of collective bargaining in the United States among the 113 international trade unions composing the American Federation of Labor; recalled the declaration of the War Labor Board and the Director General of Railroads on the subject; cited the recognition of the principle of collective bargaining in Canada, Great Britain, Sweden, Norway, Australia and Germany.

"'Open shop' is a deliberate negation of the unavoidable necessity for the organization of labor. When wage-workers are not united, employers play one worker against another in competition. They quote a tenth man, unemployed, as a menace to nine men in their employment. They take advantage of dull seasons, when unemployment is at its worst, to establish permanently wages and conditions to which the most needy workers must then give their consent. The more liberal employers themselves are finally obliged by low-wage-paying competitors to reduce wages in order to meet the price of products in the market reached through the cheapest labor costs.

"That inevitable tendency in finance by which the worse currency drives out the better—Gresham's law—is equally true in its application to labor. The employers of sweatshop labor, prison labor, child labor, non-union, woman's labor and cheap foreign labor, in various industries have repeatedly captured markets from employers conscientiously endeavoring to uphold recognized American standards. The sole effective antidote to this social disease has been the trade union."

John Spargo's Views

Mr. John Spargo, speaking as a "convinced socialist, believing that this industrial and social order must give place to another," followed Mr. Morrison, but would have preferred to follow Mr. Rockefeller directly because in so doing he might help to symbolize what he believed to be the governing purpose of the Public Group. Like many of the other speakers in the Conference, he referred to the solidarity and unity of purpose displayed by America in the war, and the necessity for similar action in the face of of industrial peril. "That spirit," he said, "has not only guided my own part, small as it is, in this group, but it is the spirit in which this group has come together; and there is nothing unusual in the fact that Mr. Rockefeller, at one end, if you will, of our social scale, and I, at the other end, unite in a common policy here and now." Pleading for union of the different elements of the Conference, Mr. Spargo said that class consciousness should not be exhibited by the groups on his right and left. "What we need is an intense sense that America cannot afford to be divided in herself if she is to prevail in the great onward march of the nations."

Addressing himself to the Employers, he said: "I ask you to consider for a moment where you place yourselves when you say that you will not permit your men to be represented by representatives of their own choosing, because, forsooth, those representatives may not be chosen from your plants. Are you going to say that you, with your vast resources, you who can command the brain and the service of the ablest counsellors in the land, in addition to starting with the advantage of great education, are you going to say, "We must hire as our representatives the best brains that we can hire, but when we deal with these poor helpless men who come and are bewildered in the strange and complex life so unfamiliar to them, we insist that we will put our high-priced attorney on one side of the table and the poor foreign workman with his little command of English on the other."

Mr. Feiss of the Public Group supported the resolution and stated that he "would have gone still further and urged every employer to assist in organizing his men so that they might have a coherent and collective voice in the determination of conditions of employment in which they must always be interested."

Mr. Endicott, of the Public Group, speaking as "one of the largest employers of labor in this country and the very largest employer of labor in my line that there is in the world," supported the resolution for collective bargaining. It developed that he had been responsible for the addendum to the resolution which provides that the wage-earner might refrain from joining any organization of employees and might deal directly with his employer if he so chose.

The Attitude of the Employers

All of the preceding debate had ensued without a statement on the part of the Employers, who, incidentally, had not supported the resolution in the Committee of Fifteen. Speaking for that group, Mr. Fish said that one reason for opposing the resolution was its indefiniteness. He contended that any resolution emanating from the Conference and going to the country as its expression should, if possible, be beyond misunderstanding. He felt, furthermore, that the matter of collective bargaining was inextricably bound up with other matters which had not even been considered by the Conference and which, when considered, might be found to affect the attitude toward this question. The proposition of the "open shop," for example, he felt to be so intimately interwoven with collective bargaining that it would be unwise to consider the one without the other. He defined the open shop as one "in which membership or non-membership in any association is of no more consequence in determining whether or not a man shall be hired or discharged than his membership in a secret fraternity or his membership in a church or his race or creed." The proposition of the open shop he believed

to be attacked by the resolution on collective bargaining because it recognized the principle of allowing non-employees or outsiders to represent the workers in a plant. He said that the employers were not opposed to collective bargaining as a principle, but they were opposed to the idea that the employer should be required to deal with a labor union as a representative of his men. "Practically what that (the resolution) means is that the men to be selected by the employees, outside their number, are to be labor union men. That is the practical thing that confronts us, and any pronunciamento on the part of this Conference that such is forced on the employers of this country seems to us improper, unwise and likely to have the most serious consequences to our industries." Mr. Fish acknowledged the "right" of employees to organize in trade and labor unions, but he denied that it was a "right" to be represented by representatives of their own choosing, when such representatives probably would have no knowledge of local conditions and who could not bring into the negotiations the single-minded devotion to the cause of the men they were representing.

Mr. Fish then moved to refer the resolution back to the Committee of Fifteen for further consideration. The motion was seconded, but the debate continued. Labor delegates expressed the opinion that it would be useless to refer the resolution back to the committee, because Labor had gone as far as it would in making concessions in the verbiage of the statement. They contended that the open or closed shop had nothing to do with the matter, and should not be injected into the debate.

The Role of Management

By far the best presentation of the case against the wording of the resolution was made by Mr. Homer L. Ferguson, president of the Chamber of Commerce of the United States and manager for the Newport News Shipbuilding Co., who is a member of the Employers Group. Mr. Ferguson spoke from the viewpoint of management, "the despised class that stands between the wage-earner and the owner." He maintained that in the settlement of any controversy between employers and employees, the terms must be such as would enable a self-respecting man to act as manager. "In handling the problem of the individual man in the individual plant, the conditions of the plant must be considered, the conditions locally surrounding the employment must be considered.

"The right to be a representative of a man in any controversy carries with it the obligation that the representation of that man shall be a primary consideration; that it shall be the first thought of the man who does the representing; that ulterior motives shall not be present. My right to employ a lawyer is an inherent right. I also have the right to demand that that lawyer shall be single in my employment. We do not ask as managers in isolated plants to have men meet with our representatives. We do not employ lawyers to meet them. As a matter of fact, business men do not employ lawyers to meet each other. When a lawyer is usually brought into any business deal that I am familiar with, an attitude of suspicion is at once created, and of antagonism.

"Now, if we are to deal with this in a spirit of friendliness, let me picture to you the position of a manager in dealing with those representatives of the men. A man comes to town from nowhere in particular, inaugurates meetings, secret for the most part; sticks out signs, starts an agitation, agitates political economy that is strange to most of the books and strange to most of the gentlemen here, except those who have heard it; organizes up the shops, presents demands which frequently illustrate in themselves that he does not know what he is talking about; claims to represent the men; the men walk out or threaten to walk out. Then we managers are told, 'You must meet that man, you must deal with him; you must meet him because we, the men, choose him to meet with you.' He is the choice of the men, yes, but the choice was made before they chose him. A representative of a great federation, representative of that federation before he represented the men; representative of it during his representation; a representative of that federation after he had left town and left behind him men who feel that much of the trouble he created could have been avoided.

"The principle [involved here] is that a man shall not be compelled to join the unions. The addendum put on this resolution is that a man shall not be compelled. It does mean it to the gentlemen that put it on, but I want to state, gentlemen, that that is an agreement that the gentlemen here cannot settle. Why? When you meet with the men, you do what? You do what has caused more strikes than any other cause, you recognize the union; you recognize the union representative, not just the local union, but the American Federation of Labor. All right. In recognizing that what do you do? You serve notice on the men throughout the plant, who may or may not belong, that the union has been recognized, and you tell them as plainly as words can that if they desire representation they should get in the union, and you tell them to, and the men tell them that they should get in and do their share.

"I have no objection to employing union men, and I hope that our concern has not discriminated against them for years; but I say that to establish a condition, whether it is established in England, in Sweden or any other place, whereby a man may not work freely without coercion, without being interfered with, is to establish an un-American condition, and is to set up a power that, in course of time, will involve us in the troubles of old countries, and by that power even we may lose our representative form of government.

"We cannot shift the seat of government from the other end of the avenue [Congress] to this hall. Great authority such as these gentlemen [Labor] ask, if conferred on them, would mean the creation of a

power in this country which, the greater it became, the more antagonism it would encounter. Mere size in this country is a tremendous thing; is a matter of tremendous moment to people.

"I am not speaking in opposition to unionism, but I am saying this, that this great country was built on the basis of equilibrium established through opposing forces, and it would be a bad thing for all of us to believe in one way only of curing our ills, either industrial, political or domestic. Power without responsibility, and an adequate responsibility in keeping with that power, is a thing that cannot be, in a free country.

"I made this remark this morning to one of the gentlemen from the other group, and he said: 'It sounds like you were speaking of the steel trust.' I say that I am speaking of any power, whether the power of capital or the power of labor, that is created in this country, and that is not clearly defined as to its responsibility—the creation of a great super-government, as it were, with greater power to settle the destinies of men than our chosen representatives.

"As an employer I do not want willingly to be put in a position of saying to a man, 'You cannot get your just deserts unless you join [the union]. You must join this or be forced out of the shop. Affairs will be so disagreeable for you that you either join this organization or get out.' And yet I have the hope that in the treatment of the men in the shop we hard-hearted managers, who have grown up with, belong to and associate with the men every day know how to treat men. We have learned that the higher we get it is 'come' instead of 'go'; and some of us have found out that great responsibility does not mean great power. He serves best who feels that he is the servant of all the men in a plant. Dictatorial orders do not exist in the settlement of wages. Men do not sit around tables and settle them at all. There are conditions which I cannot control, and which no man can control. But, in speaking the language of democracy, let us be careful that we do not indulge in practices of autocracy and create in this great country power with authority almost supreme, but without corresponding responsibility."

At the close of the debate near the hour for adjournment, Labor moved to remain in session until the matter was disposed of, but this was voted down and the Conference adjourned until the following morning.

Motion to Recommit Withdrawn

When the Conference again convened Mr. Fish withdrew his motion to recommit the resolution on collective bargaining to the Committee of Fifteen. Further debate then ensued on the motion to adopt the resolution. Mr. Wheeler of the Employers Group then introduced a substitute motion which embodied the ideas of the Employers in an effort to reach a compromise. The bone of contention, as before, was the clause "to be represented by representatives of their own choosing." Gradually the impression grew that too much haste had been urged in reporting the original resolution on collective bargaining as well as in drafting the substitute on the part of the Employers. It was apparent from the debate that no new arguments were being brought out and that another deadlock was on as strong as the one which practically brought about the temporary abandonment of the steel strike resolution. Suggestion that Labor had drawn the resolution on collective bargaining brought out the fact that the first clause was drafted by Mr. Russell and the second by Mr. Endicott, both of the Public Group. The Employers expressed abiding faith in the country and the Government, and declined to be scared into action by radicals. The issue still remained as to whether employers should be required to accept union leaders as representatives when troubles occurred in open shops; as to whether agents of the unions would be in fact single-minded representatives of the workers. Much oratory shed no new light on the subject.

Messrs. Loree, O'Leary, Gompers, Spargo and others spoke at great length, and after six hours of debate the hour of afternoon adjournment arrived with no settlement in sight. Again Mr. Chadbourne, chairman of the Committee of Fifteen and a member of the Public Group, sought to save the Conference from disruption through disagreement, and offered a resolution to adjourn, coupled with the motion to recommit both the original and substitute resolutions on collective bargaining to the Committee of Fifteen to see whether the differences might not be harmonized if more time were taken for calmer consideration. His resolution also called for adjournment over Saturday and Sunday until Monday morning, Oct. 20, at 9:30. Mr. Chadbourne thought that the debate had brought out new matter on both sides and that this should be considered before taking final action. There was considerable opposition to this suggestion of Mr. Chadbourne but it finally carried and the Conference adjourned. Thus ended the second week of the meeting, with two vital Labor resolutions still unsettled and in the balance.

Undoubtedly both the steel strike resolution and that relating to collective bargaining would have been voted down if a vote had been reached as Labor desired. The Public Group, acting as a mediator, may be said to have saved both from defeat.

The Committee of Fifteen met on Saturday to reconsider both resolutions on collective bargaining, and it is reported that all are agreed that the subject was brought before the Conference prematurely. Hope is held out for compromise on which all can agree, because there are but slight differences in wording to be reconciled, although those differences carry vital consequences. If the choice of representatives of the workers could be accomplished "free and undisturbed," it is believed that the Employers can find their way clear to agree to the resolution. The third week of the Conference will tell.

Chicago Meeting of the American Electrochemical Society

Annual Fall Meeting Marked by Large Attendance and Presentation of Important Papers That Aroused Much Discussion—Symposium on Catalysis—Session on Plating and Organic Electrochemistry

THE 36th general meeting of the American Electrochemical Society was held in Chicago, Sept. 23 to 26 inclusive in conjunction partly with the meeting of the American Institute of Mining & Metallurgical Engineers and the Fifth Annual Exposition of Chemical Industries. The first day's program was abandoned on account of the steel strike, and the members reluctantly gave up the proposed trip to the Indiana Steel Co. at Gary. A joint session on the metallurgy of iron and steel was nevertheless held with the A. I. M. E., which will be reported in the proceedings of that body.

The first business before the society on the second day was the consideration of the report of the committee on the algebraic signs of potentials. This committee has been deliberating for some time and has been unable to make a previous report. Even at this time they were unable to agree, and a report was made to which four subscribed and one dissented.

Algebraic Signs of Potentials

The report of the committee, approved by Messrs. Carl Hering, M. DeK. Thompson, F. C. Frary and W. D. Bancroft, and dissented from by O. P. Watts, is as follows:

"The committee recommends that the signs given to the potentials of electrodes be those which represent their electric charges with reference to the solutions. An element like zinc, which becomes negatively charged with respect to the solution, is therefore given a negative sign, and the sign of the calomel electrode then is plus. In charging and discharging a storage battery the current is reversed, but the polarity remains the same. This recommendation is in agreement with the more generally adopted international practice. The assumed absolute zero of potential or zero of reference should accompany the data."

The following appendix to the committee's report was presented by Dr. Carl Hering, chairman:

"In general a plus sign implies the adjective 'more' or 'higher' and a negative sign 'less' or 'lower.' Hence in the present case a plus sign implies a relatively greater activity and a negative sign a relatively less activity. One of the objections which has been made to giving metals like zinc the negative sign, is that these metals are in general the ones which are the more active from the chemical standpoint, and their chemical potential or activity would therefore naturally be given the plus sign. There is therefore an apparent disagreement between the chemical activity and the electrical activity, when as a matter of fact chemical and electrical activities in general go together.

"It is now known, however, that it is the negative electrons which are the active ones and that therefore the flow of an electric current is in fact in the opposite direction to what has long been and is still being conventionally assumed. A greater charge of negative electrons therefore represents a greater electrical activity. Hence by giving the negative sign of potential to metals like zinc which are in general the more active from a chemical standpoint, it brings the chemical activity and the electrical activity into agreement with each other.

"Another source of confusion is that the direction of flow of the current in the external circuit when referred to the poles or terminals is necessarily the opposite to that in the interior of the cell, dynamo or other source. That is, if it is assumed conventionally to flow from the positive to the negative pole in the external circuit, it necessarily flows from the negative to the positive pole in the interior of the cell. Hence in connection with the signs of the potentials of electrodes it makes a difference whether one is referring to the external or to the internal part of an electric circuit. Referred to the external circuit, the chemically more active metals like zinc are generally negative, and are the ones to be connected to the negative pole of a voltmeter."

Study of the Alloy Manganin

Messrs. M. A. Hunter and J. W. Bacon presented a paper on manganin, giving the results of an investigation into the resistivity and the temperature coefficient of resistivity of this alloy of copper, manganese, nickel and iron. The authors reach the following conclusions:

1. The percentage of manganese between the limits used affects the resistivity of the wire, but has no effect on the temperature coefficient of resistance.

2. The presence of iron affects the temperature coefficient to a considerable degree. Those wires in which the iron content was low did not show the temperature coefficient reversal which is characteristic of a manganin wire. The results show that the presence of iron up to 1 per cent improves the temperature coefficient of the resulting alloy.

3. We have confirmed the observation that during the annealing of the wire scrupulous care must be observed to avoid its oxidation.

4. We have further confirmed the observation that in order to stabilize the wire it is sufficient to anneal it at 150 deg. C. in an oil bath for a period of 5 hours.

Depreciation of Dry Cells

In a paper by Mr. A. J. Helfrecht the author endeavored to show how closely the method of judging cell deterioration, called "flash test," approached actual measurements of capacity through discharging the cells. Comparative curves for the different sizes of cells tested are given in the paper. From the data gained by this investigation the accompanying table has been compiled indicating reasonable depreciation of the four important sizes of small cells.

Size of Cells		Per Cent Depreciation per Month	
Inches	Centimeters	First Two Months	Last Ten Months
2½x1½	5.7x3.2	0.0	2.1
1⅝x⅞	4.6x2.2	0.25	4.0
1⅞ x⅝	4.8x1.6	2.0	5.5
1⅝ x⅝	4 x1.4	2.0	6.5

The Activation of Carbon

This paper, by Dr. N. K. Chaney of the Research and Development Laboratory of the National Carbon Co., was one of the most important offered at the meet-

ing. It embodies a careful study of the properties of carbon which were utilized during the war for defense against toxic gases. "Activated carbon" is a new article of commerce brought into existence by the war. The investigation of the adsorptive properties of carbon resulted in the development of a general theory dependent on two experimentally established postulates:

(1) That elementary carbon (other than diamond and graphite) exists in two modifications, "active" and "inactive," or *alpha* and *beta*.

(2) That all "primary" amorphous carbon consists essentially of a stabilized complex of hydrocarbons, adsorbed on a base of "active" or *alpha* carbon.

The active modification of carbon is characterized by a high specific adsorptive capacity for gases, etc. The inactive modification carbon exhibits no special adsorbtive capacity whatever.

In addition to this distinction in specific adsorbing power, active and inactive carbon differ in two other important particulars, *i. e.*:

(1) Temperature of formation.

(2) Chemical activity, or susceptibility to oxidation.

The active modification is formed whenever carbon is deposited at relatively low temperatures by chemical or thermal decomposition of carbon-bearing materials; in general below 500 to 600 deg. C.

The inactive modification results from similar decomposition at higher temperatures, in general above 600 to 700 deg. C.

The active form is rapidly attacked by oxidizing agents. Dr. Hulett has shown that slow oxidation occurs at room temperatures. The inactive form is relatively stable toward oxidizing agents, resembling graphite in this particular.

It is possible for the first time to prepare intelligently such active carbon on a large scale from whatever sources of carbon-bearing material may be cheapest, or most deirable for the particular purpose in view.

To sum up, active carbon is essentially a special form of pure amorphous carbon, deposited at low temperatures and free (1) from adsorbed stabilized hydrocarbons which are normally associated with it and which lessen its power of combining with other substances; (2) from inactive carbon formed by gas treating, *i. e.*, by the decomposition of hydrocarbons upon its surface at high temperatures.

Penetration of Iron by Hydrogen

This paper, by T. S. FULLER of the Research Laboratory of the General Electric Co., discussed experiments showing the effect of various conditions on the penetration of iron by nascent hydrogen at temperatures from 20 to 100 deg. C. Following is an abstract:

It is well known that iron at room temperatures is impermeable to gaseous or molecular hydrogen, but that at higher temperatures it becomes more or less permeable. It is not so well known, perhaps, that iron at room temperature is permeable to nascent or atomic hydrogen.

This paper describes experiments which were performed during an investigation of the penetration of iron by atomic hydrogen at temperatures between 20 deg. and 100 deg. C.

The apparatus used consisted of a $\frac{1}{16}$-in. seamless iron tube, plugged at the bottom, and sealed at the top to a glass U tube, having one arm closed and calibrated and the other open. The whole apparatus was completely filled with mercury and when in operation hydrogen penetrated the iron tube, and quickly rose and displaced the mercury in the closed and calibrated arm of the U. A large number of these units were used.

It was found that hydrogen penetrates iron under a great variety of conditions, all of which influence the rate.

(1) The velocity of penetration is greater for a unit immersed, without electrical connections, in 1 per cent sulphuric acid than for units electrolyzed as cathode in a like solution, with such current densities as were tried.

(2) The rate for electrolyzed units is influenced by the current—the higher the current, the higher the rate, but the relation is not a straight line function.

(3) The penetration velocity increases with each successive electrolysis, provided rest periods do not intervene, or with acid "pickling."

(4) The effect of rest or moderate heating upon units which have been electrolyzed or pickled is to restore the original resistance of the iron to the passage of hydrogen.

(5) Temperature has a marked effect, the rate of penetration increasing with the temperature. The rate of 90 deg. C. for an iron unit made cathode in 1 per cent sulphuric acid with a current = 0.2 amp. is 14 times its rate under similar conditions at 20 deg. C.

(6) The velocities of penetration for units electrolyzed in 1 per cent solutions of potassium sulphate and sodium hydroxide, and in tap water are about equal and are $\frac{1}{12}$ to $\frac{1}{15}$ the velocity of units electrolyzed in 1 per cent sulphuric acid.

(7) Hydrogen produced by the reaction between tap water at temperatures from 50 to 100 deg. C. and iron, or between steam and iron, penetrates the metal at a rate depending directly upon the temperature.

(8) The velocity of penetration for 3 per cent nickel steel is the same as that for iron.

(9) Hydrogen does not penetrate copper at a temperature of 20 deg. C.

(10) The rate for tinned iron is greater than for iron, and for galvanized, sherardized and coppered iron is less.

(11) No evidence of sulphates could be found inside a unit which had been pickled in sulphuric acid and in which 2.4 cc. of hydrogen had collected.

(12) No hydrogen penetrated a unit immersed in a solution of 1 per cent sulphuric acid plus 1 per cent potassium dichromate in 96 hours.

(13) The gas which was collected in one of the units was analyzed and found to contain 95 per cent hydrogen and 5 per cent of an uncombustible gas, possibly nitrogen.

I wish to offer the following explanation of the manner in which hydrogen is forced through iron tubes having walls $\frac{1}{16}$ in. in thickness: Atomic hydrogen which has been liberated by the current, in the case of units which were electrolyzed, or by the reaction between metal and solution, in the case of units which were not electrolyzed, penetrates the surface of the iron where gaseous or molecular hydrogen is later formed. Iron at room temperatures is impermeable to the latter. The atomic hydrogen continues to penetrate the surface of the metal rapidly and to form molecular hydrogen. The latter can escape only very slowly and as a pressure, sufficient to force the gas through the metal, is built up. It is a pressure built up in this way which also results in the well-known phenomenon of the cracking of hardened steel when "pickled" in acid.

Effect of Amalgamation on Single Potential of Aluminum and Its Alloys With Cu, Zn and Ni

In two papers on this general subject Messrs. LOUIS KAHLENBERG and J. A. MONTGOMERY, University of Wisconsin, showed that by measuring the single potential of aluminum in a ½ molar solution of aluminum chloride at room temperature, by means of the calomel electrode, much higher values were obtained with amalgamated than with unamalgamated aluminum, due to the removal of the coat of resistant oxide by the mercury. They showed also that the measurements were actually the single potentials of the aluminum and not those of an aluminum amalgam.

The highest value obtained was a 5-second reading of 1.089 volts, compared with Neumann's value of 1.01. A series of "instantaneous" readings gave approximately the same value. The most interesting results of all were the potentials of amalgamated and unamalgamated aluminum in a ½ molar solution of sodium hydroxide. A potential of 1.17 volts was obtained for both amalgamated and unmalgamated aluminum.

After the authors had found such a great change in the single potential of aluminum in a ½ molar aluminum chloride solution as a result of amalgamation, they decided to see to what extent amalgamation would change the potentials of the alloys of aluminum in the same electrolyte.

Just as aluminum, when amalgamated, gives a much higher potential than when it is unamalgamated, so the alloys of Al-Cu containing less than 50 per cent of copper have their potential greatly increased by amalgamation. The greater the per cent of aluminum, above 50 per cent of aluminum, the higher the resulting potential of the alloy.

With regard to Al-Ni it is evident that by amalgamation the initial potentials of alloys which contain less than 35 per cent Ni are much higher than the potentials of unamalgamated specimens. In the case of both Al-Cu and Al-Ni there is a break in the curve of the readings on amalgamated specimens, occurring at about the eutectic for each series. From the data on Al-Zn alloys it was concluded that they do not form definite compounds, but a series of solid solutions. The eutectic located by freezing and melting-point data has not effect on the potential curve.

Electric Furnaces and Electric Heat

In a joint session with the A. I. M. E., Mr. F. A. J. FITZGERALD presented two papers, one on a new radiant resistor furnace and the other on an electric furnace for experimental work. The radiant resistor furnace for the distillation of low-grade or scrap zinc was built and operated at the FitzGerald Laboratories and produced several tons of refined zinc. The best results were obtained with a current of approximately 845 amp. at 65 volts or 55 kw. With this power the output was about 50 kg. refined zinc per hr. The complete paper will be published in a later issue. The other paper gave details of design of a furnace that had been found useful in experimental work on account of being cheap and easy to build.

The use of electric heat in the typewriter industry was discussed in a paper by A. M. CLARK, describing an electrically heated oven for baking japan on parts of typewriters. Compared with gas- or oil-heated ovens, the electric oven showed economy and better results.

Symposium on Catalysis

Friday morning and a part of Friday afternoon were devoted to a highly interesting discussion on catalysis, in which about twenty members of the society participated. The subject was introduced by Professor HUGH S. TAYLOR of Princeton University, who referred to the catalyzer as the "chemical parson," with this distinction, that in the case of chemical processes there may be more than two contracting parties. Prof. Taylor then cited a number of well known catalytic reactions, such as the oxidation of SO_2 in the presence of platinum (contact process); the oxidation of ammonia (Ostwald process); and the hydrogenation of fats in the presence of nickel.

SOME PROBLEMS IN CONTACT CATALYSIS

Professor WILDER D. BANCROFT of Cornell then presented a paper on "Some Problems in Contact Catalysis," which follows:

There seems to be no doubt that nickel splits ethyl alcohol into acetaldehyde and hydrogen because of the selective adsorption of hydrogen by nickel. The splitting of ethyl alcohol into ethylene and water by alumina is evidently due to the selective adsorption of water by alumina. In line with this is the fact that presence of water decreases the yield of ethylene in the case of alumina and that presence of hydrogen decreases the yield of acetaldehyde in the case of nickel. These results are entirely satisfactory qualitatively, but they are not so good quantitatively. In the making of ethylene from alcohol for war purposes, it was found desirable to mix a lot of steam with the alcohol. One effect was a better heat control and the reaction was run at a higher temperature than would have been possible without the steam; but it is a little difficult to see how selective adsorption of water can play an important part in the presence of a considerable amount of water vapor. While the general theory is sound, there are details here which call for further study.

A catalytic agent ceases to function if it agglomerates so that its adsorbing power becomes negligible or if it adsorbs something which is not readily removed and which therefore cuts down the adsorption of the reacting substances. We know that if the reaction products are not removed rapidly from the catalytic agent, the reaction will slow down.

My attention has been drawn recently to several cases in which a reaction comes apparently to a standstill although no equilibrium has been reached. The experimental data are not as satisfactory as I should like; but I think that the results should be put on record for what they are worth. Phosgene reacts with water to give carbonic dioxide and hydrochloric acid,

$$COCl_2 + H_2O = CO_2 + 2HCl$$

So far as we know, this reaction is not reversible, and it actually runs to an end in presence of an excess

of water. In presence of concentrated hydrochloric acid the rate of hydrolysis is practically negligible. The only way that I can see to account for this is by assuming that water and phosgene do not react by themselves and that the reaction takes place solely in contact with the walls of the containing vessel. When these are coated with a film of hydrochloric acid of sufficient concentration, no phosgene is adsorbed to speak of and no reaction takes place. The hydrolysis should be studied with different concentrations of acid and with a varying ratio of wall surface to mass of solution.

Trichlormethylchlorformate, $ClCO_2CCl_3$, or superpalite, as it has been called, decomposes to carbon tetrachloride and carbon dioxide in presence of alumina,

$$ClCO_2CCl_3 = CO_2 + CCl_4$$

$$ClCO_2CCl_3 = 2COCl_2$$

and to phosgene in presence of ferric oxide,

The reverse reaction has never been made to take place to any measurable extent. Some superpalite and ferric oxide were placed in a glass tube connected with a closed manometer. There was rapid decomposition at first, as shown by the increase in pressure; but, before long, the reaction came apparently to an end. On raising the temperature, the reaction went a little farther and did not reverse when the temperature was brought back to its original value. This experiment was not checked sufficiently to make me willing to guarantee the results; but it looks as though the ferric oxide was poisoned and that when the temperature changed, more superpalite came in contact with the catalytic agent and was decomposed. If this is the true explanation, it suggests one interesting line of experimentation. When ethyl butyrate is treated with a small amount of enzyme, the decomposition only proceeds a little way. It seems probable that with an oscillating temperature it might be possible to carry the reaction much farther with the same amount of enzyme.

If we were to put calcium carbonate in dilute sulphuric acid and if the resulting calcium sulphate were to form a coherent film over the surface of the calcium carbonate, the reaction would come to an end as soon as the surface of the calcium carbonate was coated over completely. The apparent equilibrium would be more or less independent of the concentration of the acid. For a given size of calcium carbonate particles apparent equilibrium would be reached when a definite amount of calcium sulphate had been reached. This is self-evident in a case of this sort; but the matter is not always quite so obvious. A certain war gas, which we will call *A*, gives a solid hydrolysis product. The same amounts of *A* were treated with 250 cc. of water and with 1000 cc. of water. When apparent equilibrium was reached, the acid was four times as concentrated in the first case as in the second. Experiments were then made with dilute hydrochloric acid solutions instead of with water, and it was found that the presence of hydrochloric acid in moderate amounts had practically no effect on the amount of hydrolysis. The hydrolysis took place in every case until the ratio of hydrolysis product to undecomposed substance was a constant. Of course it should have been shown that this ratio varied with varying crystal size; but there were a good many loose ends after the war and this was one.

Some recent experiments by Lind [1] can be looked upon as a displacement of equilibrium by a catalytic agent if one so wishes. Radium emanation decomposes liquid water into hydrogen and oxygen; but causes hydrogen and oxygen to combine. If the emanation is placed in the liquid phase, hydrogen and oxygen will be formed and will escape into the vapor phase. If the emanation is moved up into the vapor phase, the reverse reaction will take place.

Discussion

Dr. Colin G. Fink in discussion took exception to Bancroft's definition of a catalytic "poison." Fink divided poisons into two distinct classes: First, those that affect the catalyzer, and second, those that affect one or more of the reacting components or the product of the reaction. It is also conceivable in reactions that pass through one or more intermediate stages that one or the other intermediate product is affected by the poison, whereas the original components are immune. Mr. M. L. Weiss referred to his study of the reaction

$$2C_6H_5NH_2 + CS_2 = H_2S + CS(NHC_6H_5)_2$$

and mentioned that the catalyzer he used seemed to have no affinity for either of the components of the reaction. [2]

Dr. Taylor, in reply, pointed out that unless very careful experiments were made, it was often difficult to remove the adsorbed material from the catalyzer and cited the case of finely divided iron retaining moisture at temperatures as high as 500 deg. C. Mr. W. R. Mott of Cleveland referred to his photochemical investigations and emphasized the point that the merest trace of iron catalyst was sufficient to bring the reactions into play. Mr. V. R. Kokatnur of Niagara Falls suggested that the difference in behavior of the catalyst Al_2O_3 as compared with that of the catalyst Fe_2O_3 in the decomposition of superpalite as mentioned by Bancroft might be attributed to the greater tendency of iron to form carbonyl.

Further Problems in Contact Catalysis

A paper on "Further Problems in Contact Catalysis" was next presented by Dr. H. S. Taylor. He emphasized that the first striking feature common to most of the contact agents successfully employed in catalytic reactions was the porous or finely divided state of the material. For example, the light, porous hydrated oxide of iron used in the fractional oxidation of hydrogen sulphide to sulphur in the purification of illuminating gas. Catalysts of this porous type usually adsorb greater or lesser quantities of gases. But Patrick's silicia gel adsorbs and yet does not act as

[1] *Trans.*, Am. Electrochem. Soc. (1918), Vol. 34, p. 211.

[2] The identity of the catalyzer was not revealed by Mr. Weiss.

a catalyzer. Carbon monoxide is adsorbed by metal oxides and readily oxidized at 100 deg. C., carbon monoxide is likewise adsorbed by charcoal, but its catalytic activity in promoting the oxidaton of the monoxide is practically nil. The influence of one gas on the other is quite marked and was clearly demonstrated by Dewar (1904), who found, for example, that 1 cc. of charcoal adsorbed 18 volumes of O_2 but only 12 volumes of O_2 to which two volumes of H_2 had been added. Catalytic poisons do not necessarily cut down the adsorption of the essential reacting substances. The effect of catalyst poisons may be due in part to a reduction in the adsorption velocity. The addition of promoters to a catalyst renders it highly reactive. For example, a mixture containing 2.5 per cent Cr_2O_3 and 0.5 per cent CeO_2 with iron oxide increases the reactivity as compared with iron oxide alone manyfold. The addition of Cu to Ni catalyst in the hydrogenation of oils increases the ruggedness of the catalytic agent and renders it less sensitive to poisons. Further investigations are needed.

Discussion

In discussing his own paper Dr Taylor felt that there was still considerable study and investigation necessary to clarify many of the peculiarities met with in catalytic reactions in general. Dr. Taylor took exception to the conclusion of N. K. Chaney brought out in his paper on the "Activation of Carbon" (Wednesday's session), that there were two kinds of the same carbon, an active and an inactive one. Comparatively inert copper oxide could be rendered very active in oxidizing hydrogen by repeated alternate reduction and re-oxidation of the copper oxide. Are we justified in concluding that there are two modifications of copper oxide, an active and an inactive one? Is it not merely a question of "degree" of activity?

Dr. S. C. Lind of Golden, Colorado, maintained that there was really only one definition for catalytic poisons: "Any substance which has an inhibiting effect upon the velocity of the reaction." In the case of the formation of hydrobromic acid from its elements he had been able to show definitely that the walls of the vessel (glass) do not affect the velocity of the reaction and that the inhibitive effect of HBr was solely in the gas phase. The reaction was very likely a pure heterogenous one. Perhaps the best interpretation of photochemical reactions is that proposed by Nernst about two years ago. His conclusions are based on good thermodynamic grounds. He assumes, for example, in the case of the reaction $H_2 + Cl_2 = 2HCl$ that light dissociates the Cl molecule (or H molecule) into its atoms and that the atomic Cl then reacts somewhat as follows:

$$H_2 + Cl = H_2Cl = HCl + H$$

and then

$$H + Cl_2 = Cl_2H = Cl + HCl, \text{ etc.}$$

The thermal data fit in splendidly. It can further be shown that the reaction comes to a standstill upon the removal of the source of radiant energy. Under the influence of Ra rays the amount of HCl is proportional to the extent of ionization.

Professor Andrews of Purdue University, commenting on Dr. Lind's remarks, was of the opinion that *all* reactions might be considered photochemical reactions and that each molecule required for its activation certain definite rays.

Dr. C. L. Parsons of Washington referred to Patrick's highly adsorptive silica gel and suggested that we might consider two modifications of silicia, an active and an inactive one. He furthermore stated that it seemed very hard to believe that adsorption by platinum took place in the case of the oxidation of NH_3, since the velocity of the gases through the gauze was at the rate of 40 cu.ft. per min. and the gauze was at a temperature of 1025 deg.

Dr. Fink in reply gave a brief account of the experiments he had carried out in 1905 with a view of determining the time required to form the adsorption film of SO_3 on Pt in the contact process and emphasized the fact that the film was formed the instant the SO_3 came into contact with the platinum; in other words, the film-forming velocity was found to be practically infinite.

Dr. Taylor cited the reaction N_2--N_3, that is, the formation of active nitrogen, and described an experiment which showed rather conclusively that the velocity of adsorption of N_3 by copper oxide was exceedingly great.

Dr. C. Hering of Philadelphia referred to his experiments on the melting of steel under water.[3] His experiments demonstrated that a gaseous film formed over the surface of the iron cathode during the high current density electrolysis in dilute sulphuric acid. The real cathode seemed to be the enveloping gaseous film and not the metal.

Thermal Problem in Organic Contact Catalysis

Dr. W. J. Huff of Pittsburgh then read his paper on "The Thermal Problem in Organic Contact Catalysis."

Dr. Huff carefully reviewed the most important organic catalytic reactions. He subdivided them into three distinct classes: (1) Those that were decidedly exothermic; (2) those that were decidedly endothermic, and (3) those that evolved or absorbed very little heat. A series of examples were cited, such as Rittman's process for the cracking of petroleum, the splitting of ethyl alcohol into ethylene and water, the commercial synthesis of formaldehyde in presence of platinum or copper, the formation of phthalic anhydride from napthalene in presence of vanadium or molybdenum oxide at temperatures of about 500 deg. C. In future developments of organic contact catalysis more stress ought to be laid on the heats of reactions. With the aid of the thermal factors conditions under which reactions are to take place can be more intelligently chosen.

[3] *Trans.*, Am. Electrochem. Soc., Vol. 30, p. 350.

The last paper of the morning session was presented my Mr. F. C. ZEISBERG of the DuPont Company on "The Thermal Problem in the Contact Process of Sulphuric Acid Manufacture."

Mr. Zeisberg outlined the underlying principles of the contact process and reviewed the work of Rudolph Knietsch, Hasenbach, Herreshoff, Ferguson and others. At present the principle most used is conversion in steps, usually in a tower-like converter containing several trays of catalyst alternating with large empty spaces in which the gas may mix before passing into the next catalyst layer. This empty space may contain cooling tubes, usually those of a heat-exchanger used to preheat the cold burner gas, or the walls thereof may be equipped to radiate heat. One large manufacturer uses the heat exchanger principle, with the walls of the converter well insulated, another uses a converter the walls of which can be insulated to a variable degree, so that the excess heat is dissipated by radiation.

Either type of converter is quite satisfactory under present conditions. The arrangement of several trays affords the opportunity of varying the concentration and amount of catalyst in each tray, by which means alone a considerable control over the heat development may be attained. The alternation of trays and mixing chambers permits an equalization of temperature which cannot help but be beneficial, for undoubtedly hot spots develop in each tray, due to easier gas passage at some points or accidental accumulation of excessive platinum in spots, and the gas coming from such a hot spot is over-heated and not completely converted. By mixing with the larger body of cooler gas coming from the same tray, before passing on to the next tray, this overheating is corrected.

Some actual figures taken from a five-tray converter not fitted with a heat exchanger which are representative of good operation are:

	Deg. C
Entrance gas	385
Exit from first tray	540 — 560
Exit from second tray	520
Exit from third tray	500
Exit from fourth tray	450
Exit from fifth tray	385

With these temperatures about 60 per cent of the SO_2 is converted in the first section, the total conversion running a little over 96 per cent.

While this style of converter, as has been mentioned above, is sufficiently satisfactory under present conditions, it is not at all certain to continue so. Very recently it has become evident that liquid SO_2 recovered from smelter fumes may be used as the source of sulphur in the contact process, instead of pyrites or brimstone. If this is done 9.5 per cent of SO_2 may be present in the entrance gas, instead of the 7 per cent when brimstone is burned, without having less than the 2 mols. of O_2 per mol. of SO_2 present which are recommended by Knietsch.

This richer entrance gas will result in higher temperatures in the converter, which may or may not be capable of being satisfactorily handled as at present. Consequently, though the problem of the disposal of heat in this particular reaction seems to have been fairly well solved at present, there is no certainty that it will remain solved, and the chemical engineer will probably have ample opportunity to continue to exercise his ingenuity on this problem in the future.

REACTIVITY AND ADSORPTION IN HETEROGENOUS CATALYSIS

The symposium on catalysis was continued in the afternoon. A paper was presented by Dr. ERIC K. RIDEAL of the University of Illinois on "Reactivity and Adsorption in Heterogenous Catalysis."

Dr. Rideal pointed out that the mechanism of heterogenous catalysis involved two separate investigations: (1) In what way does the medium in juxtaposition to the catalyst differ from that in the free space? and (2) By what mechanism is the reaction velocity increased or decreased by this alteration in the state of the medium? The conception that adsorption is the primary action in all cases of heterogenous catalysis is the viewpoint now generally adopted. Surface adsorption appears to be an instantaneous reaction, whereas intra-solid diffusion is an extremely slow process. Catalytic activity is proportional to the area of the catalytic material employed. Patrick's silica gel, which while possessing powerful adsorbing qualities and having an immense superficial area (2,500,000 sq. cm. per g.) is catalytically inert for most reactions. Three theories of the modus operandi of contact catalysis have been advanced: (1) That of Fink and Bodenstein (1907), according to which every molecule penetrating the adsorbed layer and diffusing to the catalyst reacts; (2) the single layer theory of Harkins and Langmuir (1917), according to which only those molecules of the reactants undergo chemical combination which strike the catalyst in juxtaposition to one another, and (3) the theory of Lewis, according to which we must assume that only those molecules which strike the catalyst with a certain initial energy content are capable of reacting with the catalyst to form an adsorption compound, and of these only those which become attached in juxtaposition to one another.

DISCUSSION OF DR. RIDEAL'S PAPER

In the discussion of Dr. Rideal's paper Dr. FINK referred to his actual measurements of the thickness of the adsorbed SO_3 film and that he had found that this was one molecule thick. However there seems no necessity of quibbling over the point as to whether the film was one or more molecules thick. Furthermore, the velocity of a contact catalytic reaction is not always dependent upon the diffusion velocity of the reacting gases through the adsorbed film, but may be determined by the chemical reaction. For example, in the case of the dissociation of SbH_3 on antimony (catalyst), the hydride is instantly adsorbed but slowly decomposed. The large temperature coefficient of the reaction substantiates this view.

Structure of Electrodeposited Metals

The final session was devoted to papers on plating and organic electrochemistry. Mr. WILLIAM BLUM of the Bureau of Standards reported at length on "The Structure of Electrodeposited Metals." Mr. Blum based his experiments on Profesor Bancroft's six axioms:

1. Bad deposits are due to excessive admixture of some compound or to excessively large crystals.
2. Excessive admixture of any compound can be eliminated by changing the conditions so that the compound cannot precipitate.
3. Increasing the current density, increasing the potential difference at the cathode, or lowering the temperature, decreases the size of the crystals.
4. The crystal size is decreased when there are present, at the cathode surface, substances which are adsorbed by the deposited metal.
5. If a given solution will give a good deposit at any current density, it will give a good deposit at any higher current density, provided the conditions at the cathode surface are kept constant.
6. Treeing is facilitated by a high potential drop through the solution and by conditions favorable to the formation of large crystals.

Experiments were conducted with solutions of zinc, copper and nickel, and it was found that the axioms mentioned are applicable over a very wide range of conditions.

DISCUSSION OF THE PAPER

In the discussion of the paper Dr. F. C. MATHERS commented on the importance of addition agents. He showed the members smooth deposits of silver obtained from silver nitrate solutions with tartaric acid as addition agent; on the other hand, substituting pyrogallic acid for the tartaric acid produced dark, poor deposits of silver. Similarly, black deposits of silver were obtained in the presence of ferric salts. A chloride solution of tin produced the familiar crystalline deposit, whereas sulphate bath produced heavy smooth deposits. Glue is a very poor addition agent for antimony, but aloin and clove oil gave rise to a splendid polished surface of antimony. Dr. Bancroft suggested that further study ought to be made why sulphate baths produce good deposits of tin and chloride deposits poor ones. Mr. Blum added that in the case of the sulphate bath colloidal tin oxide was present, and this might be looked upon as an "addition agent."

Lead Plating From Fluoborate Solutions

The second paper was on "Lead Plating From Fluoborate Solutions," by Messrs. W. BLUM, LISCOMB, JENKS and BAILY. A large number of experiments were put through and it was found that

(1) By increasing the concentration of lead it is possible to use higher current densities without causing treeing of deposits.

(2) An increase in current density increases the tendency to treeing but produces finer grained deposits. Therefore the highest current density should be employed that will not produce appreciable treeing, since the finer grained deposits are more nearly impervious.

(3) By increasing the concentration of excess (or "free") fluoboric acid slightly finer grained deposits are produced, and there is somewhat less tendency to form trees. This is no doubt due in part to the decrease in lead ion concentration caused by the presence of the excess acid; and in part to the increase in conductivity and consequent decreased tendency to treeing.

(4) The presence of an excess of boric acid (above that required to combine with the hydrofluoric acid) has little effect upon the deposits. It is desirable, however, to have an excess of boric acid, since it reduces any tendency to decomposition of the fluoborate and consequent precipitation of lead fluoride sludge.

(5) By the addition of small amounts of glue there is less tendency for the deposit to form trees and the deposits of a given thickness are finer grained and more nearly impervious. In preliminary experiments it was found that sugar or glucose produces some improvement in the deposits but is not so satisfactory as glue.

(6) By increasing the temperature to 50 deg. C. (122 deg. F.) the deposits become somewhat more coarsely crystalline, and show no marked improvement over deposits produced at ordinary temperature.

(7) Mechanical agitation, for example by rotation of the anode or cathode, produces smoother and denser deposits than are obtained in still solutions. This is especially helpful where the deposit must be made from a restricted volume of solution, such as in the inside of a shell or other object. Air agitation has not been found satisfactory, as it produces spongy deposits.

It is interesting to note that in every case these observations and conclusions are in accord with Bancroft's "Axioms," [4] and furnish an excellent illustration of the value of these axioms as a guide for research in this field.

In view of the very marked effect of colloids and reducing agents in producing finer crystals and especially in reducing the tendency to treeing, a few experiments were carried out with lead acetate solutions, such as were employed by Glaser. [5] Betts [6] stated that he was unable to obtain in lead acetate solutions good deposits of lead even after the addition of reducing substances such as pyrogallol which had been employed by Glaser. This observation of Betts was confirmed by us when still solutions were employed, but if as suggested (but not clearly stated or emphasized) by Glaser, the solution was agitated, for example by rotating the cathode, a smooth, dense de-

[4] *Trans.*, Amer. Electrochem. Soc. (1904), Vol. 6, p. 27, and (1913), Vol. 23, p. 266.
[5] *Zeit. Electrochemie* (1901), Vol. 7, pp. 365 and 381.
[6] Lead Refining by Electrolysis, p. 11. Wiley & Sons.

posit of lead was obtained in solutions containing

	g/L
Lead acetate	550
Ammonium acetate	140
Pyrogallol	1

An almost identical deposit was obtained in the same solution if glue (0.2 g/L) was added in place of the pyrogallol. In acetate solutions containing no organic addition agent very poor spongy deposits were obtained even with rapid agitation.

These observations indicate that although lead fluoborate solutions are intrinsically superior to lead acetate solutions in that they yield good deposits without agitation or the use of addition agents, the effect of either colloidal or reducing substances is qualitatively the same and even more marked in lead acetate than in lead fluoborate solutions. It is therefore doubtful whether the use by Betts of such substances in lead fluoborate solutions in 1902 constituted a patentable novelty.

Discussion

The paper was discussed by Messrs. Hogaboom, Fink and Mathers. Dr. Mathers discussed the relative advantages of the fluoborate and the fluosilicate baths. Glue is a good addition agent in either of these electrolytes, but in the perchlorate bath it is worthless. However, in the perchlorate bath oil of cloves is a splendid addition agent, and in the lead acetate bath aloin gives good deposits.

Commercial Possibilities in the Electrochemical Production of Organic Compounds

The final paper on the program was on the "Commercial Possibilities in the Electrochemical Production of Organic Compounds," by Dr. C. J. Thatcher of New York. Dr. Thatcher has been manufacturing for several years a series of organic chemicals by electrochemical processes. Among these chemicals worth noting are paramidophenol, hydroquinone and anthraquinone. Although the processes had been known to the Germans for several years, details were never published, and it was necessary to work out each process here step by step.

Dr. Thatcher records in his paper some of the underlying principles on which successful operation is based and points out the many advantages of electro-organic methods in comparison with older methods. It is usually cheaper to oxidize, reduce or substitute by electrolytic than by chemical means. With power at metropolitan rates it is one-tenth as cheap to oxidize electrolytically as it is by bichromate chemically. Dr. Thatcher discussed at length the application of catalytic reactions at the electrodes and referred briefly to his patented "electrofiltros" silica diaphragm, which has been in successful commercial operation since 1915. The complete paper will be published in a later issue.

Messrs. Bancroft and Fink discussed the paper. A member of the Western Reserve Chemical Co. mentioned that his company is making a number of organic products electrochemically.

World's Production of the Principal Metals

Dr. J. B. Umpleby of the U. S. G. S., in a lecture given in Paris, France, stated that during 1913 the United States produced 39 per cent of the world's coal, 36 per cent iron, 56 per cent copper, 32 per cent zinc, 30 per cent silver, 17 per cent tungsten, 38 per cent molybdenum, 65 per cent oil, 95 per cent natural gas, 16 per cent arsenic, 48 per cent phosphates and 20 per cent salt. During the same year the Transvaal produced 41 per cent of the total gold, Russia 99 per cent of the platinum and 55 per cent of the manganese, Peru 76 per cent of the vanadium, Rhodesia 35 per cent of the chrome iron ore, Canada 85 per cent of the nickel, China 53 per cent of the arsenic, India 59 per cent of the mica, Spain 54 per cent of the pyrites and 31 per cent of the mercury, Italy 43 per cent of the sulphur, Germany 92 per cent of the potash, Chile 22 per cent of the nitrate, France 58 per cent of the bauxite, Malay Peninsula 40 per cent of the tin, Austria 74 per cent of the magnesite.

Proposed Extension of War Minerals Relief Act

Liberalization of the War Minerals Relief act is to be considered promptly by the Committee on Mines and Mining of the House of Representatives. The committee will consider a bill by Representative Garland, of Pennsylvania, the chairman of the Committee on Mines and Mining, which provides for the reimbursement of claimants who undertook the production of the minerals covered by the act in response to "any personal, written or published request or demand from any of the governmental agencies as mentioned in the Act." A considerable proportion of the claims which have been filed with the War Minerals Relief Commission have been denied as a result of the Attorney General's opinion to the effect that claims could be allowed only to those having received personal requests from the Government agencies. The bill also provides for a prorating of the appropriation in case it should be insufficient to pay all claims.

A. S. T. M. Standards Adopted in 1919

The American Society for Testing Materials has published the ten standards adopted by letter ballot on Sept. 1, 1919, on the following materials and tests:

A 47-19. Malleable castings.
B 19-19. Cartridge brass.
B 20-19. Cartridge brass disks.
B 21-19. Naval brass rods for structural purposes.
B 27-19. Chemical analysis of manganese bronze.
B 28-19. Chemical analysis of gun metal.
C 12-19. Laying sewer pipe.
D 56-19. Flash point of volatile paint thinners.
D 55-19. Determination of apparent sp. gr. of sand, stone and slag screenings, and other fine non-bituminous highway materials.
D 36-19. Determination of softening point of bituminous materials other than tar-products (ring and ball method).

Meeting of Technical Association of the Pulp and Paper Industry

Meeting Practically Restricted to Committee Reports—Report and Discussions on Principles and Practice Involved in Washing Unbleached Soda Pulp—Testing Material—Pulp Molds—Exhibition—Flotation of Pulp Liquor

IN ORDER to allow time for the members to attend the Exposition, the meeting was practically restricted to committee reports and excursions to the paper mill plant of Sears, Roebuck & Co. and the Forest Products Laboratory at Madison, Wis. The report of the committee on soda pulp, MARTIN L. GRIFFIN, chairman, was the dominating feature of the meeting.

Washing Unbleached Soda Pulp

The soda process, as it is called, is the oldest of the chemical processes for the disintegration of wood into pure wood fiber. The process consists in cooking the wood, under high pressure and heat, with a strong solution of caustic soda, which dissolves the intercellular matter and forms what is commonly called "black liquor," so named from its color. This liquor must be drained off and the pulp thoroughly washed to free it from these impure residues, especially if it is to be bleached to a good white color, as is the usual practice.

It is common knowledge that the soda used in cooking the wood may be recovered by evaporating this by-product liquor to a thick consistence and then incinerating it to a product of "black ash," from which the alkali, as carbonate, may be leached in form for re-use after treatment with lime. This in general has been the practice from the beginning.

Although the soda ash is the chief and only by-product which has hitherto been reclaimed, the black liquor contains the possibilities of others of great value.

The manufacture of soda pulp divides itself naturally into two important parts—namely, the production of the pulp, including preparation of the wood, the cooking of it, washing out the residues, bleaching and finishing and the reclaiming system, beginning with the washing of the pulp, then the evaporation of the black liquor, incinerating to black ash, leaching it and finally causticizing to produce the cooking liquor in its original form, thus completing the cycle.

The pulp is the primary product, but the reclaiming system involves more chemical problems and is of prime importance. No production of pulp of any kind by the soda process can be successfully carried on without the recovery of the alkali.

The washing of the pulp is the connecting link between these two primary operations. The pulp must be washed clean and as expeditiously as possible. At the same time the residual black liquor must be kept up to as high a concentration and as small a volume as possible consistent with economy, which will involve questions like the losses of soda, the consumption of steam for evaporation, the amount of coal used for the incinerators and the cost of plant and its maintenance.

It will be the object of this committee to indicate the most advantageous means and procedure for accomplishing these results.

With the exception of the diffusion system of closed tanks in general use in the sulphate mills, it is customary to drain and wash the pulp in open tanks having a false bottom of perforated sheet metal or a system of perforated piping.

Minimum Dilution of Black Liquor

The primary object aimed at is to preserve the original volume and strength of the black liquor contained in the digester with as little dilution as possible. The ideal, from this viewpoint, would be to squeeze or press the original liquor from the pulp after being blown, and then to wash out the remainder by "counter current" in a closed system. This is not practicable by any known process. We may, however, look for marked improvements in the future by the use of some form of continuous filter or hydro-extraction which shall displace the cumbersome system of tanks and piping by which the washing proceeds progressively with resulting progressively weaker liquors. The process in brief consists in draining the original black liquor from the pulp and beginning to wash with a weak liquor which will give a resultant liquor for the evaporation of about half the original strength. Sometimes two grades in strength of weak liquors are successively used. This will of necessity prolong the cleansing operation. The supply of these weak liquors is kept up from other tanks being progressively washed.

The question naturally arises, Why is the pulp not washed, battery style, in a closed system of diffusers? I can only give a speculative answer. The most probable reasons are that in the earlier years of the history of this process, such a system was not as well developed as it is today and the industry itself did not employ chemical engineers, and so a simple process of washing in open tanks requiring no particular skill or experience came into general use. There are other reasons which make the issue debatable.

Following the course of the process in order, it is important to make provision for the transmission of the contents of the digester into the washing tanks without loss of pulp or dilution of the liquor; the proper size of the tanks, the mechanical construction of the drainage false bottoms, the arrangement of the system of piping for adding the washing liquors, and drawing them off, the organization of the department, are all very important and have much to do with the rapid and efficient execution of this part of the process.

Shallow and Deep Extraction Tanks

At this point I wish to discuss, by contrast, the extremes of two viewpoints of the process, neither of which is practicable, for the purpose of bringing out in the discussion what is the most practicable mean position. First, what must be involved in the process if we lay out an equipment of very shallow tanks, always bearing in mind our original premises, that resulting black liquors to the evaporators must be as concentrated and as small in volume as possible. We begin

the washing process and find that the strength of the outflowing liquor drops rapidly and it would require a series of weak washing liquors, differing by small degrees, to sustain a high strength of effluent. This would involve a complex system of tanks and piping, and control would be difficult. The only alternative would be to simplify the system of liquors, which would result in a larger volume of a weaker liquor going to the evaporator, with a probable loss of considerable alkali, too weak to be evaporated with economy. The only commendable thing about the shallow tank plan would be the rapidity with which the washing could be done.

The opposite extreme view would be the use of very deep tanks, wherein the depth itself would to a large degree be the equivalent of the closed system of counter current, battery style of tanks, the tanks themselves and their contents coalescing in the larger and deeper tank. The equivalent points of similarity are the opportunity to wash from the beginning with water, building up strength progressively throughout a longer course, still maintaining a fair degree of concentration as a resultant.

The use of a weak liquor followed by water would, of course, result in a much stronger effluent liquor. By such a procedure the whole process is prolonged and a larger plant and equipment become necessary.

The striking difference between the use of a deep tank and a system of small connected tanks is that in the former, all of the contents to the very bottom must be washed clean before any part of the pulp can be removed and the washing media can only reach the bottom strata by percolation from the very top, long after this part of the pulp is clean, and no pulp can be removed until washing of the whole is finished.

When using a closed system of small connected tanks, these tanks are operated in cycle order, each tank being cut out of the system, discharged, refilled and connected up again in its turn.

Thus we observe that there is a medium point between these extremes, depending upon local circumstances, where the best results may be obtained. By all of these processes, large amounts of heat are lost and the washing requires large volumes of hot water. The movement of the pulp is intermittent, thus necessitating considerable tank storage capacity at different stages of the process.

Continuous Filtration

Opposed to this old-time practice, I desire to present an entirely new view of washing soda pulp which I believe may become practical, and which I have referred to earlier in this paper.

With the rapid strides made during the last few years in mechanical continuous filtration, I believe it is quite within the range of possibility to filter and wash soda pulp with greater economy.

For many years moisture has been expelled by hydro-extractors and expression, by various devices. I am thinking of one type, consisting of a cage through which the wet material is forced by an auger-propeller squeezing out the fluid contents and delivering the mass relatively very dry. Such devices have been in use for many years for a large variety of products.

I believe it is possible and practicable to build these machines in multiple, tandem style, so as to effect a thorough and economical washing of pulp and maintain a high concentration of the liquor.

It is to be hoped that this brief exposé of some of the principles of washing soda pulp will lead to a discussion which will result in a better knowledge of the subject and give promise of more efficient and economical results in the future.

A discussion by Messrs. Spence, Bache Wiig, Beveridge and others followed, which will be published in full in *Paper* with the other committee reports.

Testing Materials

William H. Gesell gave the recommendations of the committee on the standard methods of testing materials used in the manufacture of paper. He especially urged that these methods be universally adopted throughout the industry.

Pulp Mold

Dr. Otto Kress of the Forest Products Laboratory gave an interesting paper on ground wood pulp mold. Five million dollars' worth of pulp is now being lost due to this cause, to say nothing of the hundreds of millions of dollars' worth of engineering timber construction such as railway ties, shipway, pier and dock piling, telegraph poles, etc. The whole sum of $20,000 has recently been appropriated by Congress to finance Dr. Kress's laboratory staff of nine men in their work on preservation of wood products.

Removing Pulp From Fourdrinier Waste Liquor

Among the exhibits on demonstration which were of especial interest to the paper manufactures, the Groch "Save-All" should be mentioned. It is a centrifugal flotation machine, the air drawn through the hollow shaft being disseminated through the liquor by impeller blades. Air bubbles accumulate on the fibers and balloon them up to the surface, where they are skimmed off. About six cents worth of pulp is obtained per ton of liquor. In the old practice, the greater part of this liquor was returned to be used with new pulp. This necessitated a great amount of pumping and dissatisfaction due to dirt accumulating in the system and producing an inferior quality of paper.

China's Foreign Trade for 1918

Regardless of internal disorganization, the foreign trade of China continues to show a satisfactory increase. The total foreign trade of the country for the year 1918 was the highest on record, being 1,040,776,113 haikwan taels, or approximately $1,241,645,903, the increases being 28,325,709 haikwan taels and $204,423,181. The greater value of the dollar increase is accounted for by the difference in the conversion rates, these being $1.02 in 1917 as against $1.193 for 1918.

Of the totals for 1918, Japan's share amounted to over 402,000,000 haikwan taels, or nearly $498,000,000; and that of the United States, 136,000,000 haikwan taels, or nearly $161,000,000.

Eliminating Hongkong (the trade of which port consists largely of transshipments from various foreign countries) with a percentage of 26.39, the United States comes second in the foreign trade of China with a percentage of 12.96. Therefore, after taking into consideration the shares of Japan, Hongkong and the United States in the foreign trade of China, aggregating over 79 per cent, there is left less than 21 per cent for the remainder of the world, of which the United Kingdom is credited with 7.17 per cent and France with 3.07 per cent.

Chicago Meeting, American Steel Treaters' Society

Convention of Men Practiced in the Art of Steel Treating—Exhibition of Materials, Instruments and Equipment Used in Case Hardening, Tempering, Steel Finishing, etc.

THE convention and exhibition of the American Steel Treaters' Society from Sept. 23 to 27, at the Seventh Regiment Armory, Chicago, was an endeavor to enact on a smaller scale the Chemical Exposition as carried out at the same time over at the Coliseum and the First Regiment Armory. Sixty-five exhibitors had booths, among which were exhibited various brands of steels varying in designation from yellow, red, blue, black, green, gold labels to stainless and so on. The several alloy companies had fine exhibits of vanadium, tungsten, chromium, nichrome, etc., in which they demonstrated the properties and uses of their products. The large nichrome annealing boxes were especially noteworthy. The larger instrument companies showed very complete lines of pyrometric, chemical, physical and mechanical equipment for laboratory use. Case hardening materials from R & H cyanide to special patented carbon preparations were all open to the inspection of the visitor. Oils for quenching, drawing, cleaning and rust prevention were shown in a wide variety.

Acting Officers Elected

The success of the society in its past year of existence has been largely due to the interest taken by its acting officers. These men were elected to continue in office for the coming year as follows:

T. E. Barker, president.
A. F. Boissoneau, first vice-president.
E. J. Janitzky, second vice-president.
A. G. Henry, secretary-treasurer.
F. S. Crane, board of directors.
F. C. Lau, board of directors.
A. F. McFarland, board of directors.
L. M. Rollins, board of directors.
W. H. Eiseman, business manager.

Papers Read Before the Society

About forty papers were scheduled on the program during the twelve morning, afternoon and evening sessions. These will shortly appear in the journal of the society.

Mr. C. P. Berg in his paper on the relation of cutting tool steels to factory production emphasized the need of greater knowledge of steel among operators. He said:

"During the war the main object in view was to produce everything as quickly as possible; in other words, at high speed. In a great many factories this naturally created a good deal of misplaced enthusiasm, also resulting in their ordering practically every cutting tool made of high speed steel. These same people were also wondering why their shops had so much trouble in producing work that would be up to specifications, as to finish and size on the inspector's bench. High speed steel is only intended for removing metal at a great speed and is therefore well suited for roughing tools of all kinds, but it will not keep a keen edge required for a high finish or close size, and should therefore be absolutely avoided for finishing tools. It takes a great deal more time for regrinding, trying to keep a keen edge on a high speed tool required for a good finish, than the time lost in reducing the speed of the machine suitable for a carbon tool. Production is decreased instead of increased by using high speed steels for finishing cuts.

"It is also a great deal better from a production standpoint to select only two or three kinds of high speed steels and the same number of carbon steels, instead of a great variety, for all metal cutting tools used in the factory.

"It is comparatively simple to make up standards for metal cutting and have the machine operators become used to them, when only a few kinds of steel are used."

Mr. Roy C. McKenna of the Vanadium Steel Co. gave a brief sketch of the methods used in the manufacture of high speed steels. On the whole he thought that a better product could be produced in the electric furnace than in the crucible, but that experienced crucible operators would be necessary to accomplish this. The average chemical composition was given as:

	Per Cent
Tungsten	16 to 20
Chromium	3½ to 5
Vanadium	½ to 1½
Carbon	0.62 to 0.77
Sulphur and Phosphorus	0.02 to 0.025

The presence of traces of manganese and silicon was not considered of any consequence, but copper and arsenic were not to be allowed under any circumstances. The physical treatment of the steel in rolling into bars was considered of fundamental importance, and because of this Mr. McKenna believed that the steel consumer should mainly depend on the producer in the matter of specifications and adapt himself to the brands of steel offered, which the producer offers in a reasonable variety.

C. N. Scott gave some elucidating information on the art of hardening the faces of drop hammer dies. Of the many other papers, that of Frank P. Fahy on magnetic steel should be especially noted. Mr. Fahy has performed a great amount of research work and had much of his data plotted which showed wide variations in the magnetic properties of the so-called electric steels.

British Scientists in Conference at Bournemouth

By John B. C. Kershaw

THE 1919 meeting of the British Association for the Advancement of Science was held at Bournemouth from Sept. 9 to 13, under ideal weather conditions. The meeting was well attended in view of the fact that Bournemouth is far removed from the busy manufacturing centers of the north, and that the problem of providing adequate traveling facilities and hotel accommodation had not been entirely solved by the local authorities. For the two previous years the meetings of the Association had been suspended for the first time in its history, owing to the difficulties caused by the war, and the 1919 Bournemouth meeting was therefore the first to be held under the new peace conditions.

For the benefit of those who are unacquainted with the aims and history of the Association it may be explained that it was founded at York in 1837 to promote and popularize the study of science and to extend its practical applications in the arts and industries, and that for over 80 years the members and associates have met annually in one of the leading cities or towns of the United Kingdom to hear and discuss addresses, reports and papers upon the various branches of scientific knowledge covered by the ten sections under which the work of the Association is now organized.

The Presidential Address

Sir Charles Parsons, F.R.S., the well-known engineer and designer of the Parsons steam turbine, is this year's president of the Association, and his address dealt chiefly with the services rendered by science and scientific men to the Allied Governments during the war and with the problems connected with the production of cheap power in the future, when the coal fields of the United Kingdom and of Europe will be approaching exhaustion.

With regard to the first portion of his address, the most interesting disclosure was that relating to the design and application of sound-ranging and listening devices, which have been used with great success both on land and sea during the war for localizing the exact position of batteries and submarines. The following extract from this portion of his address is of general interest:

Development of Sound-Ranging Devices

"Probably the most interesting development during the war has been the extensive application of sound-listening devices for detecting and localizing the enemy. The Indian hunter puts his ear to the ground to listen for the sound of the footsteps of his enemy. So in modern warfare science has placed in the hands of the sailor and soldier elaborate instruments to aid the ear in the detection of noises transmitted through earth, water, air or ether, and also in some cases to record these sounds graphically or photographically, so that their character and the time of their occurrence may be tabulated.

"The sound-ranging apparatus developed by Professor Bragg and his son, by which the position of an enemy gun can be determined from electrically recorded times at which the sound-wave from the gun passes over a number of receiving-stations, has enabled our artillery to concentrate their fire on the enemy's guns, and often to destroy them.

"The French began experimenting in September, 1914, with methods of locating enemy guns by sound. The English section began work in October, 1915, adopting the French methods in the first instance. By the end of 1916 the whole front was covered, and sound-ranging began to play an important part in the location of enemy batteries. During 1917 locations by sound-ranging reached about 30,000 for the whole army, this number being greater than that given by any other means of location. A single good set of observations could be relied upon to give the position of an enemy gun to about 50 yd. at 7000 yd. range. It could also be carried on during considerable artillery activity."

New Possible Sources of Power

Concerning new possible sources of power apart from coal and water power, the harnessing of the latent molecular and atomic energy of matter and the tapping of the earth's internal heat are the only two sources that would appear at present within the bounds of practical realization; and upon the latter subject Sir Charles Parsons made the following suggestive remarks:

"*Bore-Holes.* In my address to Section B in 1904, I discussed the question of sinking a shaft to a depth of twelve miles, which is about ten times the depth of any shaft in existence. The estimated cost was £5,000,000, and the time required about 85 years.

"The method of cooling the air-locks to limit the barometric pressure on the miners and other precautions were described, and the project appeared feasible. One essential factor has, however, been queried by some persons. Would the rock at the great depth crush in and destroy the shaft? Subsequent to my address, I wrote a letter to *Nature,* suggesting that the question might be tested experimentally. Professor Frank D. Adams of McGill University, Montreal, acting on the suggestion, has since carried out exhaustive experiments, published in the *Journal of Geology* for February, 1912, showing that in limestone a depth of 15 miles is probably practicable, and that in granite a depth of 30 miles might be reached. When we consider that the estimated cost of sinking a shaft to a depth of 12 miles at present-day prices is not much more than the cost of one day of the war to Great Britain alone, the expense seems trivial as compared with the possible knowledge that might be gained by an investigation into this unexplored region of the earth. It might, indeed, prove of inestimable value to science, and also throw addi-

tional light on the internal constitution of the earth, in relation to minerals of high specific gravity.

"In Italy, at Lardarello, bore-holes have been sunk, which discharge large volumes of high-pressure steam, which is being utilized to generate about 10,000 hp. by turbines. At Solfatara, near Naples, a similar project is on foot to supply power to the great works in the district. It seems, indeed, probable that in volcanic regions a very large amount of power may be in the future obtained directly or indirectly by boring into the earth, and that the whole subject merits the most careful consideration."

His Plan Bold and Original

Although Sir Charles Parsons did not elaborate further his plan of obtaining power from the interior of the earth, the idea of constructing a deep shaft, and of then allowing water to flow in for the production of steam, i. e., using the earth as an immense natural high-pressure boiler, is distinctly bold and original, and probably more practicable than the late Sir William Ramsay's project of sealing up a coal mine and then generating a mixture of air- and water-gas *in situ*, by supplying air and water to the burning fuel. The greatest difficulty in the practical application of Sir Charles Parsons' plan in fact appears to be the time required to sink the bore-hole, which he estimates at 85 years, but surely with modern methods and machinery this could be reduced considerably. Since nature is already doing in Italy what Sir Charles Parsons is proposing to do upon a much larger scale, there is nothing inherently impossible in the idea, and therefore more may be heard of this plan of generating steam power by aid of the internal heat of the earth before the present generation is 20 years older.

Address of Prof. J. E. Petavel

The address of Professor J. E. Petavel, delivered before the members of the Engineering Section of the Association, was also devoted to the services rendered by engineers and scientists during the world war, but its most valuable portion related to the industrial and economic position of the various belligerent nations during the present reconstruction period.

Since the United States is now faced with many problems of this nature, the following extracts from this portion of the address will prove of interest to readers of Chemical & Metallurgical Engineering:

"The total remuneration received by a nation is measured by its production, and this law cannot be altered or affected by legislation or revolution. On the other hand, the share received by a class or an individual is capable of adjustment within certain limits. Thus any class may increase its remuneration either by increasing the total production, or by decreasing the remuneration received by the other classes. The capitalist who corners wheat, and the miner who corners coal, are examples of the latter method. No such limitations exist, however, with regard to the face value of the wages paid; by act of Parliament all wages might be increased arbitrarily twentyfold, but as a result the cost of living would rise in a similar ratio.

"Incalculable harm has been done by ignorance and wilful misrepresentation. During a generation the working classes have been told, and have firmly believed, that they receive but a tithe of the value of their work, and that the bulk goes to swell the fortune of the capitalistic class. The actual facts, so far as engineering is concerned, will be found in the address of my predecessor in this chair. On an average in pre-war days the share of the capitalist was one-ninth that of the workman. The actual position with regard to coal is not known to all. For each ton raised 19s. 5 1/2 d. goes for labor, and a total of 2s. is paid as royalties, owners' profits and owners' compensation. It is obvious that the 13s. rise in the miner's wages cannot be paid out of profits and royalties amounting to a total of 2s., but the miner, who has been brought up to believe in the fabulous profits of the wicked duke, is quite ready to strike against the owners, the Government and the laws of arithmetic.

"The economic value of an individual depends exclusively on the nature, quality and quantity of his output, and his remuneration should correspond to his economic value. The rule is simple, its application would solve most of the problems which vex the present generation, but no scheme has yet been evolved to make its application possible.

Present Industrial System a Failure

"There can be no doubt that in this respect our present system is a complete failure. It has been built up casually in the course of the industrial warfare of the last 20 years, and each side, regardless of consequences, has entrenched itself in any position won. The result is a system nearly perfect from the point of view of offence and defence, well arranged for mutual destruction, but, like the trenches in France, unsuitable for use in time of peace.

"Among the professional and business classes the remuneration is proportional to the skill and to the effort; a barrister, an engineer, or a merchant has neither minimum wage nor fixed maximum output, and, the vagaries of chance excepted, generally speaking he gets what he is worth. At the two extremes stand riches and starvation, and the economic world can offer no stronger motive forces than the allurements of the one, the fear of the other. There is no absolute reason why the workingman should not be offered the same incentives to hard work and progress, but up to the present most efforts have tended in the opposite direction. Any form of payment by results is viewed with indifference or distrust by the unions, and past experience with piece work explains that attitude. There has been a disposition for employers to make large individual earnings an excuse for cutting rates. Errors in rate-fixing may

easily arise and in certain cases special investigation might be necessary, but the advantages of high individual production are so great to both employer and employed that in all cases of doubt the higher rate should be maintained. In this connection the method of time-study, first developed by Taylor in America, and the various systems of payment by results which have been successfully applied deserve careful consideration.

False Distinction Between Skilled and Unskilled Labor

"Another important but difficult subject is the distinction drawn between skilled and unskilled labor. The experience gained during the war has proved that many operations scheduled as skilled work could be effectively performed by women who had received only a few weeks special instruction. The oft-repeated demand for equal opportunity for all becomes a senseless parrot-cry, if it does not imply that an individual has the right to undertake better remunerated work if qualified to do so. It is a misconception which leads the skilled worker to believe that such a concession would reduce his earnings. Just as it is clear that, if laborers and skilled men were grouped together at a uniform wage, that wage would necessarily be lower than the present minimum for skilled work, so also the separation of tasks which require but a nominal period of training would increase the rate of remuneration available for the really skilled man.

Increased Production the Pressing Need

"I have drawn attention to some of the difficulties which must be solved if the country is to emerge from the present crisis prosperous or even solvent. There is little doubt that an elucidation is possible, but it can be evolved only by the honest and intelligent collaboration of all parties concerned, a task rendered difficult or impossible by mutual distrust and class hatred. Class differences there are, and always will be; they exist as the result of breeding, education and environment, but they do not extend to the fundamental characteristics of humanity. Many dukes and many miners are lazy, most capitalists and most trade unionists are greedy; all men, with a few exceptions, are selfish. The war has shown that lazy, greedy and selfish men will die, or even work for their country in a great exigency, but there is a limit to and a reaction after any profound emotional stimulus, and the present unrest and dissatisfaction are but normal symptoms. A satisfactory economic system can be based only on natural human impulses, and of these the most fundamental is self-preservation, or, more generally, self-interest. Increased production is at the present moment the most pressing national need, but it will become effective only when for every man increased production becomes the talisman by which his paper wages can be turned to gold."

Meeting of the Societe de Chimie Industrielle

THE first meeting of the season of the New York Section of this society was held in Rumford Hall at the Chemists' Club, Friday, Oct. 3. The president, Dr. L. H. Baekeland, occupied the chair, and Mr. J. V. N. Dorr was elected treasurer to succeed Dr. George F. Kunz, who resigned.

Lieutenant René Engel, formerly of the French High Scientific Mission, and a councillor of the parent society in Paris, spoke on the fuel problem in Europe, and more particularly in France. He had spent a number of months in the Saar region, and said that the return to a normal state of output, even with the former Prussian government mines, is very slow. Owing to the destruction of French mines, the deficit in France will be greater this year than usual, despite the accessions of mineral territory. The production of Alsace-Lorraine for 1919 is estimated to be about 26,000,000 tons, of which local industries and requirements take 14,000,000. The peace-time production of the district is a little less than 14,000,000 tons, against consumption in the same region of 5,500,000 tons.

Mr. Engel expressed the belief that French mines can be made to yield considerably better returns by improved methods, provided the prejudices of the miners can be overcome. The present situation, pretty well throughout Europe, is bad. Men will not do a day's work under any conditions. An average of 1 1/2 tons per man per day has dropped down to 5/8 ton, while the average per man here is 3 tons. He followed with proposals for more economical uses of coal which are familiar to our readers. There are still technologists in France, he said, who oppose the use of coal powder on the ground that it is impracticable, citing an explosion in a cement works in 1913 as ground for their objection. The use of benzene for explosion engines is more general there than here. Good results have been obtained by mixtures with gasoline in ratios of from 1 : 1 to 1 : 3.

Chemical Warfare in France

Lieutenant-Colonel J. Enrique Zanetti, Ph.D., assistant professor of chemistry, Columbia University, told of his experiences in chemical warfare in France. It may be recalled that, in an interview which we published with Brigadier-General Fries, who commanded the American Chemical Warfare Service in Europe, he referred to Colonel Zanetti as an officer of singular efficiency and competence. As liaison officer, the speaker said, he was appointed the official beggar from the French, and he doubted if the job of begging could be made more pleasant.

His first impressions of the French laboratories were those of surprise at their dinginess and lack of equipment. As a French professor explained to him, they could not with their love of tradition tear down their old buildings very well, and he proved this by

showing his balance room in an apartment 600 years old with walls five feet thick. Col. Zanetti soon concluded, however, that it calls for something more than a Ph.D. diploma and an up-to-date laboratory to get to work and obtain results.

When the war came upon them there was no liquid chlorine in France. Such as they had needed theretofore had been obtained from Germany, and at rates so low as to arouse suspicion that the Germans did not want to have the chlorine industry developed in a neighboring territory. In addition to remarkably low prices the liquid chlorine had been delivered to them f.o.b. at the French border. It took no little ingenuity to develop large production, especially as they were sorely deficient in electrical equipment. Any one having experience in chlorine manufacture will surely admit this, nevertheless within a year after the first chlorine attack upon the British, the French were turning out 30 tons daily of the liquefied gas and within one year nearly 50 tons. This amount was not enough and 1600 tons were shipped from the United States to France in 1918, making an extremely valuable contribution at an intensely critical period.

Quick Production of Phosgene

Phosgene was scarcely used before the war, and suddenly it had to be made on a vast scale. This was quickly mastered by the French. The United States was too late and Great Britain was too slow. The French made 24 tons daily in five factories. The same may be said of mustard gas, of which at the time of the armistice from 20 to 25 tons per day were available from French establishments.

In other words, practically all the phosgene and mustard that was shot over the German lines was made in France. The mustard and phosgene from the United States arrived too late, although we shipped great quantities of both. Only the armistice saved the Germans from what would have been a deluge of gas.

The difference between the French and American methods was that while the French took their problems as war-time propositions and used any kind of apparatus that would serve to achieve production in moderate sized units, with speed as their watchword, we went at it as an industrial proposition with quantity production as our slogan. Thus the French synthesized, manufactured and fired mustard within six months. It reached the enemy in time. The German High Command had talked freely of the terrors of this gas, and of the desolation it caused among the Allies. When they got it back the German troops remembered these things, and their morale was anything but improved by the retaliation.

Another point made was the astuteness with which political troubles were met by the French authorities. Every inventor in France, nearly, invented a gas mask, and back of each inventor was a member of the Chamber of Deputies who was resolved to save the country by that particular device, otherwise not only he, but the whole world, would know the reason why! It was soon discovered, as in this country, that not one in ten thousand of the inventions of these self-appointed geniuses was worth looking into. So the Chief of the Department built a gas room that would hold fifty men. The inventors were invited in groups each one to wear his own mask, to enter and to remain in this room for ten minutes. As soon as the door was closed chlorine was turned on to a concentration equivalent to that met in the field. At the end of three minutes there was seldom more than a few left, and it was rare indeed that any one remained there through the fourth or fifth minute. This procedure invariably satisfied the inventor and silenced the Deputy. There was no argument, and the test was conclusive.

A Texan's Service to England

Mr. Clinton P. Townsend of Washington, consultant of the Bureau of Ordnance, related some of his experiences in England, more particularly in connection with that country's war chemistry and the production of munitions. He sought first Mr. Kenneth Quinan, a Texan by birth, who had lived for the score of years preceding 1914 as a chemical engineer in South Africa, engaged chiefly in setting up explosive works. Five hours after Great Britain entered the war Mr. Quinan was en route for England, where he was made head of the Department of Explosive Supply in the chemical service. In contrast to the secrecy which we in this country maintained, Mr. Quinan showed him a map of England, with every factory spotted off, and a record of what each was making, how it was making it, and the quantity produced. The main thought in the English munition works seemed to be of maximum efficiency. No one appeared to be hurried, but in every factory there was a chart showing how that plant was doing, and comparisons were made with all other works engaged in similar production. Mr. Townsend said that the 5000 Welsh girls who worked in a plant that he examined showed the same interest in the competitive returns that an American crowd displays in watching the bulletins of a ball game in a world series. This whole spirit, he said, was due to the remarkable organizing ability of one man, and he was Kenneth Quinan. He concluded with some personal notes in regard to Mr. Quinan's methods. By 1914 he had already designed and built about 500 chemical plants, so that he had had abundant opportunity to put his theories into practice.

Given a problem, his first step is to get all the information available about the reactions, including a careful investigation into the endothermic or exothermic nature of each. Then, along with the study of the nature of the materials and of the various kinds of apparatus that are available, he prepares a heat flow sheet as a primary requirement before making plans, and a complete allocation of heat is made before any apparatus is designed. Semi-commercial plants do not appeal to him as a rule; they seem more frequently to be mere excuses for shiftless laboratory work.

Personal

Dr. R. A. BAKER, recently Major, Chemical Warfare Service, and Commandant of the U. S. Gas School at Camp Kendrick, N. J., and prior to that assistant professor of inorganic chemistry at the University of Minnesota, has been appointed professor of general and inorganic chemistry at Syracuse University, Syracuse, N. Y.

Mr. ALFRED C. CHAMBERS, who recently resigned his position as chief of the Quality of Water Division, Water Resources Branch of the Geological Survey, is now connected with the Youngstown Sheet & Tube Co., Youngstown, Ohio, as chemist in its laboratory.

Prof. J. B. CHURCHILL, formerly professor of chemistry in the University of Pennsylvania, has been appointed technical chemical director of the British-American Chemical Corporation.

Mr. J. H. DEPPELER of the Metal & Thermit Corp. has been elected a vice-president of the American Welding Society, New York.

Mr. PAUL A. KEENE, who has been engaged in Government nitrogen fixation, has accepted a position with the Solvay Process Co. in its laboratory in Syracuse, N. Y.

Mr. MILO W. KREJCI has been appointed superintendent of the International Lead Products Co. and will have charge of the operations at the new plant at East Chicago, Indiana.

Mr. EDWIN LUDLOW has opened an office as consulting engineer at 149 Broadway, New York City.

Mr. WALTER F. MEISTER, formerly chief chemist for the Eagle-Picher Lead Co., is now chief chemist for the Collinsville Zinc Corp., Collinsville, Ill.

Mr. JOSEPH E. PLUMSTEAD has accepted the position of assistant superintendent of the Delaware Mills plant of the Jessup & Moore Paper Co. and consulting chemist for its five pulp and paper plants. He was formerly doing development work for the Celluloid Co., Newark, N. J.

Prof. MERLE RANDALL has returned to the University of California, Berkeley, Calif., after having spent the summer as research chemist in the laboratories of the Experimental Kelp-Potash Plant of the U. S. Department of Agriculture, Summerland, Calif.

Mr. C. M. SALLS, formerly with Canadian Explosives, Ltd., is now chemist with the Canada Starch Co. of Cardinal, Ontario, Can., which is the Canadian branch of the Corn Products Refining Co.

Mr. BERNARD H. SMITH, formerly chemist and superintendent of the Baker Extract Co., Springfield, Mass., has accepted a similar position with Garrett & Co., Brooklyn, N. Y.

Dr. JOHN E. TEEPLE, 50 East 41st Street, New York City, has been elected treasurer of the American Chemical Society to fill the unexpired term of Dr. E. G. Love.

Mr. P. F. WILLIS, president of the Henderson-Willis Welding & Cutting Co., has been elected a director of the American Welding Society.

Book Reviews

THE CONDENSED CHEMICAL DICTIONARY. Compiled by the editorial staff of the *Chemical Engineering Catalog*. 525 pages. New York, The Chemical Catalog Co., Inc.

The difficulties encountered in attempting to obtain quickly data on commodities selected at random from the wide range of chemicals having commercial applications are perhaps fully realized only by those who have been called upon to obtain such information in reply to miscellaneous inquiries. Often a search through the standard books of reference fails, and recourse must be had to text books, periodicals and other literature dealing with the subject. Such a process is tedious even to those trained in this work; and to those business men who require chemical facts but have not had a chemical training—impossible.

The Condensed Chemical Dictionary represents a compilation from the sources mentioned above (and many others) of useful data concerning over 7000 products in daily use in the chemical industry. Its appearance will therefore be welcomed not only by the busy chemist but by exporters and importers, brokers, purchasing agents, financial houses and others seeking reliable information free from commercially irrelevant scientific detail.

In addition to the name of the commodity, the following data are given wherever possible: Formula, color and properties, constants (boiling point, melting point, specific gravity, solubilities, etc.), derivation (brief statement of process of manufacture), method of purification, grades, containers, uses, fire hazard and railroad shipping regulations.

The book is exceptionally free from typographical errors. Inconsistencies of minor importance will be noted occasionally, for example on pages 94 and 95. On page 94 we find that barium hydroxide is prepared "by dissolving barium oxide in water and subsequent crystallization," while on page 95 it is stated that barium oxide is made "by calcining barium hydroxide." Also, on page 196 under dimethylglyoxime method *c*: "Nitrosomethylethyl ketone is prepared from methylethyl ketone, amyl alcohol and hydrochloric acid * * * Obviously, amyl nitrite should be read in place of amyl alcohol. Such minor errors do not, however, detract from the value of the book (as it is not intended to be a handbook of chemical manufacturing methods) but serve rather to emphasize the difficulties which confronted the editors in their task of sifting such a large mass of data. They are to be heartily congratulated upon the fruit of their endeavors. ALAN G. WIKOFF.

CHEMISTS' FIRST-AID TREATMENT. By *Paul Nicholas Leech*. 11 pages. Chicago: The Chicago Chemical Bulletin.

The author was selected by the *Bulletin* to write this pamphlet as a chemist who was in touch with medicine. The subjects are covered under chapters, as follows:

I. The Emergency Treatment of Burns.
II. The Emergency Treatment of Abrasions, Bruises, etc.
III. The Emergency Treatment of Internal Conditions.
Addenda. Poisoning.

The work is covered in a more comprehensive manner than by a simple antidote list and should be very useful to laboratory and works operators. CHESTER H. JONES.

Current Market Reports

The Non-Ferrous Metal Market

Monday, Oct. 20.—The non-ferrous markets have reflected the effects of the steel strike, with the result that present quotations are practically nominal and in spite of this are advancing.

Aluminum:—Transactions are largely made on direct contract between producer and consumers. The open market is not active; 98-99 per cent ingots are quoted at 32-33c. per lb; cast scrap, 24½-25½c.; sheet scrap, 23-24c; and clippings, 26½-28c.

Antimony:—The market is easy; spot wholesale is quoted at 8¾c. and futures at 8c. lb. Small job lots, 9c. lb.

Copper:—Copper is practically nominal with sellers waiting for the demand to develop.

Copper, lake	22¾ — 23½
Copper, electrolytic	22 — 22½
Copper sheets, hot-rolled	33¼
Copper sheets, cold-rolled	35
Copper bottoms	41½
Copper rods	25
Copper wire	26
High brass wire & sheets	27¾
High brass rods	26¾
Low brass wire & sheets	30½
Low brass rods	31¼
Brazed brass tubing	39
Brazed bronze tubing	44¾
Seamless copper tubing	37½
Seamless bronze tubing	40
Seamless brass tubing	36
Scrap, heavy mach. comp	17 — 19
Scrap, heavy and wire	17 — 18
Scrap, light and bottoms	15 — 16
Scrap, heavy, cut and crucible	18¼ — 20
Scrap brass, heavy	10 — 11
Scrap brass, casting	12 — 13
Scrap brass, light	9 — 10
Scrap, No. 1 clean brass turnings	10 — 10¾
Scrap, No. 1 comp. turnings	15 — 16½

Lead:—The market for lead has continued to strengthen. East St. Louis now quotes at 6.3c. and New York 6½c. lb.

Tin:—Incoming tin continues to be tied up in the port due to the strike of the longshoremen. Small stocks are being held at 57c. lb.

Zinc:—Zinc continues at 7.65c. both in New York and St. Louis.

OTHER METALS

Bismuth	lb.	$2.95 — .....
Cadmium	lb.	1.50 — 1.75
Cobalt	lb.	2.50 — 3.50
Magnesium	lb.	1.75 — 2.10
Mercury	75 lb.	80.00 — 95.00
Nickel	lb.	.41 — .45
Iridium	oz.	175.00 — .....
Palladium	oz.	115.00 — 120.00
Platinum	oz.	130.00 — .....
Silver	oz.	1.18⅜ — .....

The Iron and Steel Market

The iron and steel strike has been waning since last report, but at a very slow rate. This review covers the fourth week of the strike. At the inception the appraisal of the manufacturers was that if the strike should seriously cripple the majority of the producing districts it would probably be a long drawn out affair, a matter of say two to four months, but that if some districts, including the Pittsburgh district, could be kept operating moderately well the strike would play out in a very few weeks, say from two to four weeks.

The strike started out by agreeing with the second alternative, since it left Western Pennsylvania in fairly good operating condition, and did not curtail production in the whole industry by as much as 50 per cent, but now, after four weeks, it is not receding as rapidly as it was expected to do with such circumstances. The number of men at work in the Pittsburgh district increases day by day, but even with the spectacle of nearly all the mills running in good shape some strikers still stay out.

It was problematical when there would be any considerable return of men in the strike districts where the stoppage of production was complete, and where the breaks would first occur. The first district to begin resumption proves to be the Mahoning Valley, but instead of the beginning marking a stampede the men are returning to work very slowly. In that valley there are 27 blast-furnaces, of which 22 were active just before the strike, and all were closed by the end of the second day. Now only about five are operating, and it is understood they are not in all cases approaching normal tonnage. At least three of the four large open-hearth producers in Youngstown are producing a little steel, having only a few furnaces operating. So far as known only one bessemer converter is operating.

Tonnage Outputs

The ingot production report for September has not been issued yet, but as the strike began on the 22d the report would not be illuminating. The August report showed production of steel ingots in the industry as a whole at the rate of about 39,100,000 gross tons a year, and except when, as during the war, there is an abnormal distribution of steel among the different finished lines, the finished rolled steel output runs at about 76 per cent of the ingot tonnage. With a trifling increase over the August rate, there would have been a rate just before the strike of about 2,500,000 gross tons of finished rolled steel a month. At its maximum the curtailment was more than 40 per cent, but hardly as much as 50 per cent, and at the end of the first 30 days of the strike the production rate is about 60 per cent. Thus the first month of the strike witnessed a loss in output between 1,000,000 and 1,250,000 gross tons. Should a quick return of men to work begin in the next week or two output would require several weeks for even an approximate return to normal, and nearly a million tons more would be lost after the first month, so that the minimum loss in tonnage may be set at 2,000,000 tons. The maximum, even if the strike continues to wane only slowly, as at present, would be unlikely to exceed 3,000,000 tons.

The steel market has of course been very quiet. Mills are booking some contract tonnage from regular customers, merely as a routine matter. There is no mill in position to take on orders for early deliveries. Consumers continue to show the utmost patience in the matter of deliveries, assuring producers that while they wish to know what deliveries may be expected they are anxious not to embarass the mills by making requests for deliveries.

Stocks in consumers' hands seem to be holding out fairly well, and probably somewhat better than was expected. It is quite certain that there were no large stocks anywhere, and that the production before the strike was passing directly into consumption.

Pig Iron

There has been active buying of pig iron in the East, where some consumers are short on account of the strike curtailing output at Buffalo, while the eastern Pennsylvania and Virginia furnaces are not affected by the strike. No. 2 foundry delivered Philadelphia, $30.60 in September, is now up to $32.10. The Pittsburgh and valley markets are unchanged and show only a moderate demand, merchant pig iron production in that section being very slightly affected by the strike.

The Chemical Market

New York, October 20, 1919.

The delays in making deliveries and the holding up of export business, brought about by the various labor disputes, have reduced inquiries on many commodities and tied up business to a great extent. Manufacturers of coal-tar products are bending their efforts toward meeting all contracts, and their interest in the spot market is therefore small. Good demand and none too abundant supplies, with the probable return of the speculative element, combine to make a bull market on vegetable oils. Why linseed oil should jump to $1.81 per gal. for spot goods is unaccountable, considering that England has on hand abundant supplies of this oil. With the harbor strike in full force, the naval stores market was in a strong position at the beginning of the week, but it weakened at the close when shipping conditions improved. There are no spot supplies of spirits of turpentine, although stocks of rosins are fair.

Heavy Chemicals

Resulting from the recently noted scarcity of *sulphuric acid*, the 66 deg. variety is being held at higher figures in some quarters. Some dealers are holding it at $18 to $20 per ton in tank cars, whereas formerly it could be bought as low as $15 per ton. Manufacturers in the Middle West are said to be asking $22.50 per ton, f.o.b. works. Former quotations of $12 to $13 per ton on the 60 deg. are strictly maintained.

Sodium nitrite relaxed slightly during the past week and can now be bought around 13 to 14c. per lb., comparing with the previous quotation of 15 to 18c. *Sodium bichromate*, however, shows the opposite tendency and is firmer at an increase of ½c. over the minimum quotation of 12c. per lb. of last week.

Attributable to depleted supplies resulting from England's inability to make shipments is the higher minimum offering price of *caustic soda* by second hands of $3.30 per cwt. One sale of 600 tons at $1.85 per cwt. at works was reported. Several inquiries regarding contracts on this commodity and *soda ash* have been received, but manufacturers in the face of present conditions are in no hurry to take them up. A few small contracts for *zinc oxide, lithopone* and *sodium silicate* are the only ones reported as signed recently. Spot soda ash is in strong demand, and the dense is difficult to get at $2.25 per cwt. ex-store.

The continued scarcity has increased the minimum price of *aqua ammonia* another 1c. per lb., 9c. now being the lowest mark.

Sal ammoniac is going to be very scarce owing to the present shortage of ammonia and *muriatic acid*, the latter being in large request from color manufacturers. Manufacturers of sal ammoniac are usually able to meet English quotations on this chemical, but with jobbers at present quoting 11½c. per lb. for English goods, they are out of the market.

Although *sodium prussiate*, yellow, afloat from England is being offered at 24c. per lb., spot material holds unchanged at 26-27c.

General Chemicals

WHOLESALE PRICES IN NEW YORK MARKET, OCT. 20, 1919

		Carlots	Less Carlots
Acetic anhydride	lb.	.....	$0.55 -$0.60
Acetone	lb.	$0.13½-$0.14	.15 - .15½
Acid, acetic, 28 per cent	cwt.	2.50 - 3.00	3.00 - 3.25
Acetic, 56 per cent	cwt.	5.00 - 5.50	6.00 - 6.50
Acetic, glacial, 99½ per cent, carboys	cwt.	12.00 -12.50	12.90 -13.50
Boric, crystals	lb.	.13 - .13½	.13½- .14
Boric, powder	lb.	.13 - .13½	.13½- .14
Hydrochloric, (muriatic) tech. 20 deg.	cwt.	1.50 - 1.75	2.00 - 2.50
Hydrofluoric, 52 deg.	lb.	.12 -	.14 - .....
Lactic, 44 per cent. tech.	lb.	.11 - .14	.12 - .16
Lactic, 22 per cent. tech.	lb.	.05 - .06	.05½- .07
Molybdic, C. P.	lb.	..... -	4.00 - 4.25
Nitric, 40 deg.	lb.	.06 - .06½	.07 - .08½
Nitric, 42 deg.	lb.	.07 - .07½	.08 - .....
Oxalic, crystals	lb.	.23 - .25	.25 - .30
Phosphoric, Ortho, 50 per cent. solution	lb.	.09 -	.10 - .14
Picric	lb.	.30 - .35	.40 - .50
Pyrogallic, resublimed	lb.	..... -	2.30 - 2.60
Sulphuric, 60 deg., tank cars	ton	12.00 -16.00	..... - .....
Sulphuric, 60 deg., drums	ton	17.00 -	22.00 - .....
Sulphuric, 60 deg., carboys	ton	20.00 -	25.00 - .....
Sulphuric, 66 deg., tank cars	ton	17.00 -18.00	22.00 -23.00
Sulphuric, 66 deg., drums	ton	20.00 -21.00	25.00 -26.00
Sulphuric, 66 deg., carboys	ton	25.00 -	30.00 -40.00
Sulphuric, fuming, 20 per cent. (oleum) tank cars	ton	20.00 -	27.00 - .....
Sulphuric, fuming, 20 per cent. (oleum) drums	ton	25.00 -	32.00 - .....
Sulphuric, fuming, 20 per cent. (oleum) carboys	ton	30.00 -	35.00 - .....
Tannic, U. S. P.	lb.	..... -	1.35 - 1.45
Tannic (tech.)	lb.	..... -	.42 - .55
Tartaric, crystals	lb.	..... -	.73 - .75
Tungstic, per lb. of WO	lb.	..... -	1.20 - 1.40
Alcohol, Ethyl	gal.	4.80 -	4.95 - .....
Alcohol, Methyl	gal.	1.30 -	1.33 - 1.38
Alcohol, denatured, 188 proof	gal.	.56 -	1.58 - .60
Alcohol, denatured, 190 proof	gal.	.54 - .56	.56 - .60
Alum, ammonia lump	lb.	.03½- .04½	.04½- .04½
Alum, potash lump	lb.	.08 - .08½	.09 - .09½
Alum, chrome lump	lb.	.15 - .16	.18 - .20
Aluminum sulphate, commercial	lb.	.01½- .02	.02½- .02½
Aluminum sulphate, iron free	lb.	.02½- .03	.03½- .03½
Aqua ammonia, 26 deg., drums (750 lb.)	lb.	.08 -	.08½- .09
Ammonia, anhydrous, cylinders (100-150 lb.)	lb.	..... -	.30 - .35
Ammonium carbonate, powder	lb.	.13 - .13½	.14 - .14½
Ammonium chloride, granular (white salammoniac)	lb.	.12½- .13	.13½- .14
Ammonium chloride, granular (gray salammoniac)	lb.	.12 - .12½	.13 - .13½
Ammonium nitrate	lb.	.10 -	.11 - .12
Ammonium sulphate	lb.	.05 -	.06 - .....
Amyl acetate	gal.	..... -	3.75 - 4.00
Arsenic, oxide, lumps (white arsenic)	lb.	..... -	.09 - .09½
Arsenic, sulphide, powdered (red arsenic)	lb.	..... -	..... - .....
Barium chloride	ton	85.00 -	90.00 -100.00
Barium dioxide (peroxide)	lb.	.22 -	.24 - .....
Barium nitrate	lb.	.10 - .10½	.11 - .12
Barium sulphate (precip.) (blanc fixe)	lb.	.03 - .03½	.03½- .04
Bleaching powder (see calcium hypochlorite)		..... -	..... - .....
Blue Vitriol (see copper sulphate)		..... -	..... - .....
Borax (see sodium borate)		..... -	..... - .....
Brimstone (see sulphur, roll)		..... -	..... - .....
Bromine	lb.	..... -	.65 - .75
Calcium acetate	cwt.	2.00 - 2.05	2.10 - .....
Calcium carbide	lb.	..... -	.04½- .05
Calcium chloride, fused, lump	ton	19.00 -25.00	30.00 -40.00
Calcium chloride, granulated	lb.	.01½- .01½	.02 - .02½
Calcium hypochlorite (bleaching powder)	cwt.	2.25 - 2.50	.... - 2.75
Calcium peroxide	lb.	..... -	1.50 - 1.70
Calcium phosphate, monobasic	lb.	..... -	.75 - .....
Calcium sulphate, precipitated	lb.	..... -	.09 - .09½
Carbon bisulphide	lb.	.05½-	.06 - ....
Carbon tetrachloride, drums	lb.	.10 - .11	.12 - .14
Carbonyl chloride (phosgene)	lb.	..... -	.75 - .....
Caustic potash (see potassium hydroxide)		..... -	..... - .....
Caustic soda (see sodium hydroxide)		..... -	..... - .....
Chlorine, gas, liquid-cylinders (100 lb.)	lb.	.05 - .05½	.08 - .....
Cobalt oxide	lb.	..... -	1.50 - 1.55
Copperas (see iron sulphate)		..... -	..... - .....
Copper carbonate, green precipitate	lb.	..... -	.28 - .31
Copper cyanide	lb.	..... -	.65 - .70
Copper sulphate, crystals	lb.	.09 -	.09½- ....
Cream of tartar (see potassium bitartrate)		..... -	..... - .....
Epsom salt (see magnesium sulphate)		..... -	..... - .....
Formaldehyde, 40 per cent.	lb.	..... -	.22½- .24
Glauber's salt (see sodium sulphate)		..... -	..... - .....
Glycerine	lb.	..... -	.19 - .21
Iodine, resublimed	lb.	..... -	4.50 - .....
Iron oxide, red	lb.	..... -	.03 - .20
Iron sulphate, (copperas)	cwt.	1.00 -	1.20 - 1.50
Lead acetate, normal	lb.	..... -	.12½- .14½
Lead arsenate (paste)	lb.	..... -	.13 - .17
Lead nitrate, crystals	lb.	..... -	.85 - .86½
Litharge	lb.	..... -	.09½- .10½
Lithium Carbonate	lb.	..... -	.50 - .....
Magnesium carbonate, technical	lb.	..... -	.13 - .14½
Magnesium sulphate, U. S. P.	100 lb.	2.00 - 2.63	2.75 - 3.00
Magnesium sulphate, commercial	100 lb.	1.75 -	2.00 - 2.50
Nickel salt, double	lb.	.14 -	.15 - .....
Nickel salt, single	lb.	.12 -	.15 - .16
Phosgene (see carbonyl chloride)		..... -	..... - .....
Phosphorus, red	lb.	..... -	.60 - .70
Phosphorus, yellow	lb.	..... -	.35 - .37
Potassium bichromate	lb.	.28 - .30	.... - ....
Potassium bitartrate (cream of Tartar)	lb.	..... -	.55 - .60
Potassium bromide, granular	lb.	..... -	.... - .50
Potassium carbonate, U. S. P.	lb.	.60 -	.65 - .70
Potassium carbonate, crude	lb.	.19 -	.21 - .....
Potassium chlorate, crystals	lb.	.20 - .24	.25 - .30
Potassium cyanide, 98-99 per cent.	lb.	nominal	
Potassium hydroxide (caustic potash)	lb.	.30 - .32	.35 - .40
Potassium iodide	lb.	..... -	3.55 - 3.60
Potassium nitrate	lb.	.19 -	.21 - .....
Potassium permanganate	lb.	..... -	.55 - .65
Potassium prussiate, red	lb.	..... -	1.05 - 1.15
Potassium prussiate, yellow	lb.	..... -	.45 - .55
Potassium sulphate	ton	225.00 -	..... - .....
Rochelle salts (see sodium potas, tartrate)		..... -	..... - .....
Salammoniac (see ammonium chloride)		..... -	..... - .....
Sal soda (see sodium carbonate)		..... -	..... - .....
Salt cake (sodium sulphate)	ton	17.00 -21.00	..... - .....
Silver cyanide	oz.	..... -	1.19 - .....
Silver nitrate	oz.	..... -	.69½- .70½
Soda ash, light	100 lb.	2.00 -	2.25 - .....
Soda ash, dense	100 lb.	2.25 -	2.50 - 2.75
Sodium acetate	lb.	.05½- .06½	.07 - .08
Sodium bicarbonate	100 lb.	2.35 -	2.75 - 3.00
Sodium bichromate	lb.	.12½- .12½	.13 - .13½
Sodium bisulphate (nitre cake)	ton	3.00 - 8.00	10.00 - .....
Sodium bisulphite	cwt.	1.80 - 1.90	2.00 - 2.10
Sodium borate (borax)	lb.	.08½-	.09 - .09½
Sodium carbonate (sal soda)	100 lb.	1.35 - 1.50	1.50 - 1.75
Sodium chlorate	lb.	.15 -	.16 - .18½
Sodium cyanide	lb.	.30 -	.31 - .34
Sodium fluoride	lb.	.14 -	.15 - .16
Sodium hydroxide (caustic soda)	100 lb.	3.30 - 3.40	3.45 - 3.50
Sodium molybdate	lb.	2.50 -	3.25 - .....
Sodium nitrate	100 lb.	3.00 - 3.25	3.75 - 4.00
Sodium nitrite	lb.	.14 - .17	.... - .18
Sodium peroxide, powdered	lb.	..... -	.30 - .32
Sodium phosphate, dibasic	lb.	.03½- .04	.04½- .05
Sodium potassium tartrate (Rochelle salts)	lb.	..... -	.43 - .45½
Sodium prussiate, yellow	lb.	.26 - .27	.27½- .28
Sodium silicate, solution (40 deg.)	lb.	.01½- .02	.02 - .02½
Sodium silicate, solution (60 deg.)	lb.	.02½- .03	.03½- .04½
Sodium sulphate, crystals (Glauber's salts)	cwt.	2.00 -	2.25 - ....
Sodium sulphide, crystal, 60-62 per cent. (conc)	lb.	..... -	.05 - .06
Sodium sulphite, crystals	lb.	.03½-	.04 - .06
Strontium nitrate, crystals	lb.	.25 -	.28 - .....
Sulphur chloride	lb.	.05½-	.06 - .....
Sulphur, crude	ton	22.00 -	..... - .....
Sulphur dioxide, liquid, cylinders	lb.	..... -	.10 - .12
Sulphur (sublimed), flour	100 lb.	3.10 -	3.40 - 3.65
Sulphur, roll (brimstone)	100 lb.	2.95 -	3.15 - 3.40
Tin bichloride (stannous)	lb.	.44 -	.46 - .50
Tin oxide	lb.	..... -	.60 - .....
Zinc carbonate, precipitate	lb.	..... -	.20 - .....
Zinc chloride, gran.	lb.	.12½-	.13½- .14
Zinc cyanide	lb.	.49 -	.50 - .....
Zinc dust	lb.	.09 - .11	.11 - .14
Zinc oxide, dry American	lb.	..... -	.09½- .09½
Zinc sulphate	lb.	.03½- .03½	.04 - .04½

Coal-Tar Products

NOTE—The following prices are for original packages in large quantities:

Alpha naphthol, crude	lb.	$1.00 —	$1.10
Alpha naphthol, refined	lb.	1.40 —	1.50
Alpha naphthylamine	lb.	.32 —	.50
Aniline oil, drums extra	lb.	.32 —	.33
Aniline salts	lb.	.33 —	.36
Anthracine, 80% in drums (100 lb.)	lb.	.90 —	1.00
Benzaldehyde (f.f.c.)	lb.	1.00 —	1.15
Benzidine, base	lb.	1.00 —	1.25
Benzidine, sulphate	lb.	.90 —	1.15
Benzoic acid, U. S. P.	lb.	.90 —	1.10
Benzoate of soda, U. S. P.	lb.	.85 —	1.10
Benzol, pure, water-white, in drums (100 lb.)	gal.	.29 —	....
Benzol, 90%, in drums (100 lb.)	gal.	.24 —	.28
Benzyl chloride, 95-97%, refined	lb.	.35 —	.40
Benzyl chloride, tech.	lb.	.25 —	.35
Beta naphthol benzoate	lb.	3.75 —	4.50
Beta naphthol, sublimed	lb.	.75 —	.80
Beta naphthol, tech.	lb.	.45 —	.55
Beta naphthylamine, sublimed	lb.	2.25 —	2.35
Cresol, U. S. P., in drums (100 lb.)	lb.	.18 —	....
Ortho-cresol, in drums (100 lb.)	lb.	.23 —	.25
Cresylic acid, 97-99%, straw color, in drums	gal.	.80 —	.90
Cresylic acid, 95-97%, dark, in drums	gal.	.80 —	.85
Cresylic acid, 50%, first quality, drums	gal.	.60 —	....
Dichlorbenzol	lb.	.07 —	.10
Diethylaniline	lb.	1.40 —	2.25
Dimethylaniline	lb.	.60 —	....
Dinitrobenzol	lb.	.26 —	.37
Dinitroclorbenzol	lb.	.25 —	.30
Dinitronaphthaline	lb.	.45 —	.55
Dinitrophenol	lb.	.32 —	.36
Dinitrotoluol	lb.	.38 —	.45
Dip oil, 25%, tar acids, car lots, in drums	gal.	.38 —	.65
Diphenylamine	lb.	.58 —	.75
H-acid	lb.	1.60 —	1.75
Metaphenylenediamine	lb.	1.15 —	1.80
Monochlorbenzol	lb.	.12 —	.15
Monoethylaniline	lb.	1.50 —	1.75
Naphthaline crushed, in bbls. (250 lb.)	lb.	.06 —	.08
Naphthaline, flake	lb.	.06½ —	.07½
Naphthaline, balls	lb.	.08½ —	.10
Naphthionic acid, crude	lb.	.75 —	1.25
Nitrobenzol	lb.	.14 —	.19
Nitro-naphthaline	lb.	.35 —	.45
Nitro-toluol	lb.	.27 —	.20
Ortho-amidophenol	lb.	3.00 —	4.25
Ortho-dichlor-benzol	lb.	.15 —	.20
Ortho-nitro-phenol	lb.	.80 —	1.25
Ortho-nitro-toluol	lb.	.25 —	.40
Ortho-toluidine	lb.	.25 —	.45
Para-amidophenol, base	lb.	2.50 —	3.50
Para-amidophenol, HCl	lb.	2.50 —	3.25
Para-dichlor-benzol	lb.	.15 —	.18
Paranitraniline	lb.	.95 —	1.10
Para-nitro-toluol	lb.	1.35 —	1.50
Paraphenylenediamine	lb.	2.50 —	4.00
Paratoluidine	lb.	1.50 —	2.50
Phthalic anhydride	lb.	1.50 —	2.15
Phenol, U. S. P., drums (dest.), (240 lb.)	lb.	.20 —	.22
Pyridin	gal.	2.50 —	....
Resorcin, technical	lb.	3.50 —	3.75
Resorcin, pure	lb.	6.50 —	6.75
Salicylic acid, tech., in bbls. (110 lb.)	lb.	.38 —	.45
Salicylic acid, U. S. P.	lb.	.45 —	.50
Salol	lb.	.90 —	.95
Solvent naphtha, water-white, in drums, 100 gal.	gal.	.20 —	.27
Solvent naphtha, crude, heavy, in drums, 100 gal.	gal.	.18 —	.24
Sulphanilic acid, crude	lb.	.25 —	.30

Tolidine	lb.	$1.70	—	$2.50
Toluidine, mixed	lb.	.45	—	.55
Toluol, in tank cars	gal.	.26	—	....
Toluol, in drums	gal.	.27	—	.30
Xylidine, drums, 100 gal.	lb.	.44	—	.50
Xylol, pure, in drums	gal.	.37	—	.45
Xylol, pure, in tank cars	gal.	.35	—	....
Xylol, commercial, in drums, 100 gal.	gal.	.23	—	.27
Xylol, commercial, in tank cars	gal.	.22	—	....

Waxes

Prices based on original packages in large quantities.

Beeswax, natural crude, yellow	lb.	$0.42	—	$0.44
Beeswax, refined, yellow	lb.	.46	—	.48
Beeswax, white pure	lb.	.64	—	.66
Carnauba, No. 1	lb.	.85	—	.88
Carnauba, No. 2, regular	lb.	.67	—	.80
Carnauba, No. 3, North Country	lb.	.48	—	.50
Japan	lb.	.18	—	.20
Paraffine waxes, crude match wax (white) 105-110 m.p.	lb.	.06	—	...
Paraffine waxes, crude, scale 124-126 m.p.	lb.	.06	—	...
Paraffine waxes, refined, 118-120 m.p.	lb.	.07½	—	.08
Paraffine waxes, refined, 128-130 m.p.	lb.	.09	—	...
Paraffine waxes, refined, 133-135 m.p.	lb.	.10½	—	.11½
Paraffine waxes, refined, 135-137 m.p.	lb.	.12	—	.13½
Stearic acid, single pressed	lb.	.26	—	.28
Stearic acid, double pressed	lb.	.27	—	.29
Stearic acid, triple pressed	lb.	.31	—	.33

Flotation Oils

All prices are f.o.b. New York, unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Pine oil, steam dist., sp. gr., 0.930-0.940	gal.	$1.15
Pine oil, pure, dest. dist.	gal.	1.00
Pine tar oil, ref., sp. gr. 1.025-1.035	gal.	.45
Pine tar oil, crude, sp.gr.1.025-1.035 tank cars f.o.b. Jacksonville, Fla.	gal.	.34
Pine tar oil, double ref., sp.gr. 0.965-0.990	gal.	.65
Pine tar, ref., thin, sp. gr., 1.080-1.960	gal.	.38
Turpentine, crude, sp. gr., 0.900-0.970	gal.	.85
Hardwood oil, f.o.b. Mich., sp. gr., 0.960-0.990	gal.	.30
Pinewood creosote, ref.	gal.	.48

Naval Stores

The following prices are f.o.b., New York, for carload lots.

Rosin B-D, bbl.	280 lb.	$17.00	—	$18.50
Rosin E-I	280 lb.	17.75	—	19.50
Rosin K-N	280 lb.	20.50	—	23.00
Rosin W. G.-W. W.	280 lb.	23.50	—	24.25
Wood rosin, bbl.	280 lb.	16.00	—	18.00
Spirits of turpentine	gal.	1.68	—	1.69
Wood turpentine, steam dist.	gal.	1.65	—	....
Wood turpentine, dest. dist.	gal.	1.48	—	....
Pine tar pitch, bbl.	200 lb.	8.25	—	8.50
Tar, kiln burned, bbl. (500 lb.)	bbl.	13.50	—	14.25
Retort tar, bbl.	280 lb.	14.50	—	14.90
Rosin oil, first run	gal.	.86	—	.91
Rosin oil, second run	gal.	.88	—	.93
Rosin oil, third run	gal.	.95	—	1.07
Rosin oil, fourth run	gal.	1.05	—	1.10

Solvents

73-76 deg., steel bbls. (85 lb.)	gal.	$0.33½	
70-72 deg., steel bbls. (85 lb.)	gal.	.31½	
68-70 deg., steel bbls. (85 lb.)	gal.	.30½	
V. M. and P. naphtha, steel bbls. (85 lb.)	gal.	.23½	

Crude Rubber

Para—Upriver fine	lb.	$0.53	—	$0.53½
Upriver coarse	lb.	.35	—	.35½
Upriver caucho ball	lb.	.34½	—	.35½
Plantation—First latex crepe	lb.	.52	—	...
Ribbed smoked sheets	lb.	.50	—	...
Brown crepe, thin, clean	lb.	.33	—	.44
Amber crepe No. 1	lb.	.48	—	...

Oils

VEGETABLE

Unless otherwise noted, the following prices are f.o.b., New York.

Castor oil, No. 3, in bbls.	lb.	$0.18	—	$0.19
Castor oil, AA, in bbls.	lb.	.21	—	.22
China wood oil, in bbls.	lb.	.22	—	.23
Cocoanut oil, Ceylon grade, in bbls.	lb.	.17½	—	.18
Cocoanut oil, Cochin grade, in bbls.	lb.	.19	—	.20
Corn oil, crude, in bbls.	lb.	.17	—	.23
Cottonseed oil, crude (f.o.b. mill)	lb.	.18	—	.19
Cottonseed oil, summer yellow	lb.	.24	—	...
Cottonseed oil, winter yellow	lb.	.25	—	.25½
Linseed oil, raw, car lots	gal.	1.80	—	1.81
Linseed oil, raw, tank cars	gal.	1.65	—	1.73
Linseed oil, boiled, car lots	gal.	1.70	—	1.82
Olive oil, commercial	gal.	2.40	—	2.50
Palm, Lagos	lb.	.17	—	.17½
Palm, bright red	lb.	.16½	—	.17½
Palm, Niger	lb.	.16	—	.17
Peanut oil, crude, tank cars (f.o.b. mill)	lb.	.21	—	.24
Peanut oil, refined, in bbls.	lb.	.24	—	.27
Rapeseed oil, refined in bbls.	gal.	1.50	—	1.60
Rapeseed oil, blown, in bbls.	gal.	1.57	—	1.70
Soya bean oil (Manchurian), in bbls., N. Y.	lb.	.17½	—	.18
Soya bean oil, tank cars, f.o.b., Pacific coast	lb.	.14½	—	.15½

FISH

Winter pressed Menhaden	gal.	$1.28	—	....
Yellow bleached Menhaden	gal.	1.30	—	$1.31
White bleached Menhaden	gal.	1.32	—	....
Blown Menhaden	gal.	1.34	—	1.38

Miscellaneous Materials

All Prices f.o.b., N. Y.

Barytes, domestic, white, floated	ton	$25.00	—	$36.00
Barytes, off color	ton	20.00	—	25.00
Blanc fixe, dry	lb.	.03½	—	.04½
Blanc fixe, pulp	ton	35.00	—	47.50
Casein	lb.	.16	—	.18
Chalk, English, extra light	lb.	.05	—	.07
Chalk, English, light	lb.	.04½	—	.06
Chalk, English, dense	lb.	$ .04	—	$ .05
China clay (Kaolin), imported, lump	ton	25.00	—	35.00
China clay (Kaolin), imported, powdered	ton	30.00	—	60.00
China clay (Kaolin), domestic, lump	ton	10.00	—	20.00
China clay (Kaolin), domestic, powdered	ton	25.00	—	40.00
Feldspar	ton	12.00	—	16.00
Fluorspar, acid grade, lump, f.o.b. mines	net ton	30.00	—	35.00
Fluorspar, acid grade, ground, f.o.b. mines	net ton	35.00	—	45.00
Fuller's earth, domestic, powdered	ton	30.00	—	40.00
Fuller's earth, imported, powdered	ton	....	—	....
Pumice stone, imported	lb.	.03	—	.06
Pumice stone, domestic	lb.	.02½	—	....
Shellac, TN	lb.	1.00	—	....
Shellac, D. C.	lb.	....	—	....
Shellac, V. S. O.	lb.	....	—	....
Shellac, Diamond I.	lb.	....	—	....
Shellac, orange, fine	lb.	1.05	—	....
Shellac, orange, superfine	lb.	1.10	—	1.30
Shellac, A.C. garnet	lb.	1.00	—	....
Shellac, bleached, bone dry	lb.	1.25	—	....
Shellac, bleached, fresh ground	lb.	1.20	—	....
Soapstone	ton	15.00	—	25.00
Talc, domestic	ton	16.00	—	60.00
Talc, imported	ton	55.00	—	60.00

Refractories

Following prices are f.o.b. works:

Chrome brick	net ton	80-90 at Chester, Penn.
Chrome cement	net ton	45-50 at Chester, Penn.
Clay brick, 1st quality fireclay	net ton	35-45 at Clearfield, Penn.
Clay brick, 2nd quality	net ton	30-35 at Clearfield, Penn.
Magnesite, dead burned	net ton	50-55 at Chester, Penn.
Magnesite brick, 9 x 4½ x 2½ in.	net ton	80-90 at Chester, Penn.
Silica brick	net ton	41-45 at Mt. Union, Penn.

Ferro-alloys

All prices f.o.b. works.

Ferro-carbon-titanium, 15-18%, f.o.b. Niagara Falls, N. Y.	net ton	$200.00	—	$250.00
Ferro-chrome, per lb. of Cr. contained, 6-8% carbon	lb.	.25	—	.40
Ferro-chrome, per lb. of Cr. contained, 2-4% carbon	lb.	.70	—	....
Ferro-manganese, 70-80% Mn	gross ton	105.00	—	115.00
Spiegeleisen, 16-20% Mn	gross ton	35.00	—	36.00
Ferro-molydenum, per lb. of Mo	lb.	2.50	—	3.00
Ferro-silicon, 50%	gross ton	85.00	—	95.00
Ferro-silicon, 75%	gross ton	150.00	—	175.00
Ferro-silicon, 10-15%	gross ton	45.00	—	60.00
Ferro-tungsten, 70-80%, per lb. of contained W.	lb.	1.25	—	1.40
Ferro-uranium, 35-50% of U	lb.	7.00	—	....
Ferro-vanadium, 30-40% per lb. of contained V.	lb.	5.50	—	7.00

Ores and Semi-finished Products

Chrome ore, 35-40%, Cr_2O_3	unit	$0.60	—	$0.80
Chrome ore, 48% and over	unit	.90	—	1.00
Coke, foundry, f.o.b. ovens	net ton	5.50	—	6.00
Coke, furnace, f.o.b. ovens	net ton	4.00	—	5.50
Petroleum coke, refinery, Atlantic seaboard	net ton	13.00	—	....
Fluorspar, gravel, f.o.b. mines	net ton	20.00	—	25.00
Manganese ore, 45% Mn and over	unit	.50	—	.75
Manganese ore, chemical (MnO_2)	gross ton	60.00	—	70.00
Molybdenite, 85% MoS_2, per lb. of MoS_2	lb.	.75	—	.85
Tungsten, Scheelite, 60% WO_3 and over, per unit of WO_3	unit	9.00	—	15.00
Tungsten, Wolframite, 60% WO_3 and over, per unit of WO_3	unit	7.50	—	10.00
Uranium oxide, 96%	lb.	....	—	....
Vanadium pentoxide, 99%	lb.	6.00	—	....
Pyrites, foreign, lump	unit	.13	—	....
Pyrites, foreign, fine	unit	.13	—	....
Pyrites, domestic, fine	unit	.14	—	.17½
Ilmenite, 52% TiO_2, f.o.b. N. Y.	net ton	40.00	—	....
Rutile, 95% TiO_2, f.o.b. N. Y.	net ton	200.00	—	....
Carnotite, minimum 2% U_3O_8, per lb. of U_3O_8	lb.	2.75	—	3.00
Zircon, washed, iron free, f.o.b. N. Y.	net ton	135.00	—	....
Monazite, per unit of ThO_2, f.o.b. N. Y.	unit	42.00	—	....

Plant Materials and Supplies

In carload lots, New York, unless otherwise stated.

BUILDING MATERIALS

Portland cement, at dock, without bags	bbl.	$2.80
Lump lime, common, including container	300 bbl.	2.65
Common brick, at dock	M.	16.00
Yellow pine, 3x4 to 8x8, 20 ft. and under	M.	48.00
Yellow pine, 3x4 to 8x8, 20 ft. and under at Chicago	M.	50.00
Yellow pine, 3x4 to 8x8, 20 ft. and under at St. Louis	M.	40.00
Roofings, tar felt (14 lb. per 100 sq.ft.)	ton	60.00–70.00
Roofings, tar pitch (in 400-lb. bbl.) carlots	ton	21.00
Roofings, asphalt pitch carlots	ton	34.00
Roofings, asphalt felt carlots	ton	63.00
Roofings, slate-surfaced, per roll of 108 sq.ft. carlots		2.25
Roofings, slate-finished shingles, 100 sq.ft. carlots		6.00
Linseed oil, raw in barrels	gal.	2.15
Linseed oil, 5 gal. cans	gal.	2.30
Red lead, dry, 100 lb. keg	lb.	.13
Red lead, in oil, 100 lb. keg	lb.	.14½
Red lead, dry, 5 lb. cans	lb.	.15
Red lead, in oil, 5 lb. cans	lb.	.16½
White lead, dry and in oil, 100 lb. keg	lb.	.13
White lead, dry and in oil, 25 and 50 lb. kegs	lb.	.13½
White lead, dry and in oil, 5 lb. cans	lb.	.15

STRUCTURAL STEEL, MILL, PITTSBURGH

Beams and channels, 3 to 15-in.	100 lb.	$2.45
Angles, 3 to 6-in., ¼-in. thick	100 lb.	2.45
Tees, 3-in. and larger	100 lb.	2.45
Plates	100 lb.	2.66
Rivets, structural, ½-in. and larger	100 lb.	4.20
Rivets, conehead for boilers, ½-in. and larger	100 lb.	4.30
Sheets, No. 28 black	100 lb.	4.35
Sheets, No. 10 blue annealed	100 lb.	3.55
Sheets, No. 28 galvanized	100 lb.	5.70

For painted corrugated sheets, add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gage; for galvanized corrugated sheets, add 15c., all gages.

INDUSTRIAL

Financial, Construction and Manufacturers' News

Construction and Operation

NOTE—These items were compiled as of Nov. 12, but appear in this issue due to the delay in publication due to the printers' strike.

Arizona

CANON—The Kay Copper Co. is in the market for a large compressor, drills, machine sharpeners, hoist and engines for sinking the new 3-compartment 1000-ft. shaft at the Kay mine here. Estimated cost, $25,000. F. S. Poss, Adams Hotel, Phoenix, superintendent. Noted Sept. 14.

GLOBE—The Iron Cap Copper Co. had plans prepared for the construction of a coarse crushing plant at mine of No. 7½ gyratory and 48-in. Symons disc crushers. The company will be in the market for mill equipment of all sorts. Estimated cost, $200,000. E. G. Morgan, superintendent. Noted Apr. 15.

KELVIN—The Gila Devolpment Co. plans to construct a 25-ton mill 6 miles east of here, consisting of crusher, rolls and Chilean mill and plates; ore free milling, in upper part of mine. Will probably add Wilfley tables and possibly a cyanide plant early in the coming year. Tailings from initial operations to be stacked for future treatment by cyanide process, if desirable. The company will be in the market for tables, cyanide equipment, etc. Estimated cost, $15,000. J. C. Devine, superintendent.

KELVIN—The White Metals Mining Co. plans to construct a complete concentration plant. The company will be in the market for breakers, rolls, tube or ball mill, classifiers, tables and a flotation unit of some sort. Estimated cost, $30,000. J. C. Devine, manager.

California

WHITTIER—The Standard Oil Co., 1727 North Spring St., Los Angeles, has purchased a site of 93 acres near here and plans to construct an oil refinery on same.

Colorado

FT. COLLINS—The State Board of Agriculture will soon award the contract for the construction of a 3-story, 52 x 106-ft. physics building on the grounds of the Agricultural College. Estimated cost, $100,000. Maurice Briscoe, 248 Boylston St., Boston, Mass., architect.

Connecticut

WATERBURY—The American Brass Co., Grand and Meadow Sts., has awarded the contract for the construction of a 1-story, 88 x 420-ft. factory addition on Freight St., to the Torrington Building Co., 197 Water St., Torrington. Estimated cost, $125,000.

Florida

TALLAHASSEE—The city plans to build one mile of sewer and a septic tank on Duval and Bronough Sts. Estimated cost, $10,000.

Idaho

BOISE—The Idaho Co-operative Sugar Co., 90 Idaho St., plans to erect 4 large beet sugar factories, southwest of here. Estimated cost, $2,000,000. R. G. Cole, manager.

Illinois

CHICAGO—Adams & Elting Co., 716 West Washington St., has awarded the contract for the construction of a 1-story, 32 x 40-ft. and a 1-story, 26 x48-ft. paint manufacturing plant at Kostner Ave. and Taylor St., to A. C. Thielberg, 154 West Randolph St. Estimated cost, $100,000.

CHICAGO—The Ideal Coated Paper Co., 38 South Dearborn St., has awarded the contract for the construction of a 2-story, 70 x 135-ft. factory, at 4329 South Western Ave., to E. W. Sproul Co., 2001 West 39th St. Estimated cost, $90,000.

CHICAGO—Sears Roebuck & Co., Howard and Homan Aves., has awarded the contract for the construction of a 5-story, 125 x 127-ft. addition to its wall paper factory, to the Dahl-Stedman Co., 11 South LaSalle St. Estimated cost, $225,000. Noted Sept. 14.

EVANSTON—The International Lubricant Co., Ltd., 350 North Clark St., Chicago, will soon award the contract for the construction of a 2-story, 50 x 100-ft. factory on Greenleaf Ave. Estimated cost, $20,000. D. H. Burnham & Co., 209 South LaSalle St., architect.

Kansas

NESS CITY—The Board of Education is having plans prepared for the construction of a 3-story high school. Plans include a septic tank and private water supply system. Estimated cost, $65,000. R. A. Curtis, Kansas City, Mo., architect.

WICHITA—The Sterling Oil & Refining Co., 511 Beacon Bldg., plans to construct an oil refinery. Estimated cost, $100,000.

Maryland

BALTIMORE—The Edro Richardson Brass Co., 318 North Holliday St., will soon receive bids for the construction of a brass foundry on Exeter St. Estimated cost between $15,000 and $20,000.

BALTIMORE—The Zem Chemical Co., Inc., 211 North Calvert St., recently organized, plans to construct a factory for the manufacture of patented chemical preparations. Address R. I. Esslinger, 1514 East Baltimore St.

Massachusetts

EAST BOSTON—I. Young & Co., 85 Borden St., will soon award the contract for the construction of a 2-story, 74 x 80 ft. factory on Borden St. Estimated cost, $28,000.

Michigan

ANN HARBOR—The University of Michigan will soon award the contract for the installation of laboratory equipment in the proposed 6-story hospital which it plans to build on East Ann St. Estimated cost, $1,000,000. Albert Kahn, Marquette Bldg., engineer and architect.

DETROIT—The Detroit Motor Castings Co., toine St., plans to build a 4-story hospital at Hamilton Boulevard and Blaine Avenue. A laboratory will be installed in same. Estimated cost, $350,000.

DETROIT—The Detroit Motor Castings Co., Beaufait St., is having plans prepared for the construction of a 1-story, 60 x 155-ft. brass foundry. Estimated cost, $35,000. Louis Scisorek, 225 Farwell Bldg., architect.

DETROIT—The National Oxygen Co., 176 Oakland Ave., has awarded the contract for the construction of a 1-story 40 x 22-ft. oxygen factory to Hazleton & Clark, Book Bldg. Estimated cost, $10,000. Noted Sept. 14.

GRAND RAPIDS—The Kent Steel Co., 523 Bond Ave., has purchased a site on Scribner Ave., and plans to build a fabricating factory on same.

HAMTRAMCK—The Acme White Lead & Color Works, St. Aubin Ave., and Michigan Central R. R., has awarded the contract for the construction of a 4-story, 73 x 161-ft. paint factory, to the Foundation Co., Hotel Statler, Detroit.

Missouri

ST. JOSEPH—The St. Joseph Structural Steel Co., 4th and Franklin Sts., plans to construct a steel plant at 8th and Atchison Sts. Estimated cost, $75,000. Work will be done by day labor.

Nebraska

BATTLE CREEK—The city is making surveys for the construction of a sewerage system and a disposal plant. Estimated cost, $45,000. W. E. Standeven, 617 Bee Bldg., Omaha, engineer.

New Jersey

EDGEWATER—The U. S. Aluminum Co. has awarded the contract for the construction of an 80 x 450-ft. and an 80 x 176-ft. steel factory, to the Turner Construction Co., 244 Madison Ave., New York City, Estimated cost, $1,000,000.

PHILLIPSBURG—The city has awarded the contract for constructing and equipping the proposed sewage disposal plant, to the Municipal Disposal Co., Philadelphia, $137,980. Noted Feb. 15.

New York

BELMONT—The Borden Condensed Milk Co., 108 Hudson St., New York City, has awarded the contract for the construction of a 2-story, 140 x 270-ft. powdered milk plant, to the Jamestown Construction Co., 60 River St., Jamestown.

GENEVA—The Geneva Glass Manufacturing Co., Avenue F and Ontario St., recently organized, will construct an addition to the plant of the old Geneva Glass Co., and install new machinery in same. Estimated cost between $50,000 and $60,000. Address J. O. Jensen, Ontario St.

NIAGARA FALLS—The National Carbon Co., Madison St., N. W. and West 117th St., has awarded the contract for the construction of a 1-story, 60 x 100-ft. coke drier plant, to J. F. McKinney Corporation, Gluck Bldg. Estimated cost, $40,000.

SYRACUSE—The Onondaga Milk Producers Co-operative Association has awarded the contract for the construction of a dairy on Burnet Ave., to W. J. Burns, Keith Bldg. A bacteriological laboratory will be installed in same. Estimated cost, $100,000.

North Carolina

SPRINGHOPE—The city will soon award the contract for the construction of a sewage disposal plant. Estimated cost, $60,000. J. J. Wells, Rocky Mount, engineer.

Ohio

CLEVELAND—The Ohio Varnish Co., East 87th St. and Kinsman Rd., has awarded the contract for the construction of a 3-story, 56x97-ft. factory addition, to G. A. Rutherford Co., 1922 East 18th St. Estimated cost, $40,000.

CLEVELAND—The Crescent Brass Manufacturing Co., 8410 Lake Ave., has awarded the contract for the construction of a 4-story, 65 x 100-ft. factory, to the Webber Co., 1609 West 25th St. Estimated cost, $50,000.

CLEVELAND—The Osborn Engineering Co., engineer, 2848 Prospect Ave., will receive bids about Dec. 15 for the construction of a 3-story, 100 x 150-ft. factory on Euclid Ave. and London Rd., for the Cleveland Fruit Juice Co., 1382 West 9th St. Estimated cost, $150,000. H. A. Van Gorder, president. Noted Aug. 15.

CLEVELAND—The Osborn Engineering Co., engineer, 2848 Prospect Ave., is receiving bids for the construction of a 4-story, 51 x 110-ft. factory at 11100 Madison Ave., for the Glidden Varnish Co., Madison Ave. Estimated cost, $110,000.

CLEVELAND—The Union Tire & Rubber Co., Hippodrome Bldg., is having plans prepared for the construction of a 3-story, 165 x 190-ft. rubber plant. Estimated cost, $125,000. Osborn Engineering Co., 2848 Prospect Ave., engineer.

COLUMBUS—The American Zinc, Lead & Smelting Co., Pierce Bldg., St. Louis, Mo. has purchased a tract on Windsor Ave., and plans to erect a plant for the manufacture of zinc oxide.

COLUMBUS—The Columbus Brass Co., 767 North 4th St., has awarded the contract for the construction of a 25 x 87-ft. factory, to C. W. Schneider & Son, Ohio Electric Terminal Bldg. Estimated cost, $6000.

DAYTON—The Greene Engineering Co., Delphos Ave., plans to construct a 1-story, 60x135-ft. factory for the manufacture of aluminum pistons. Estimated cost, $20,000. Pretzinger & Musselman, Union Bank Bldg., architects.

ELYRIA—The city has retained M. Knowles, engineer, Jones Law Bldg., Pittsburgh, Pa., to make a study and submit sketches for a new filtration plant in connection with the proposed water system.

MEDINA—The village plans to construct a sewerage system and a disposal plant. George Gascoigne, City Hall, Cleveland, engineer.

SPRINGFIELD—The Victor Rubber Co. has awarded the contract for the construction of a 1-story, 50x120-ft. and a 1-story, 40x100-ft. rubber factory on West St., to B. O. Largent, Springfield. Estimated cost, $20,000.

VERMILLION—The city has awarded the contract for the construction of a sewage disposal plant, to the American Construction Co., Marion Bldg.,Cleveland. Estimated cost, $25,000.

Oklahoma

BARTLESVILLE—The Washington County Medical Society plans to build a bacteriological laboratory. Estimated cost, $50,000. Address Dr. A. North.

Pennsylvania

FRANKLIN—Morris Knowles, consulting engineer, Jones Law Bldg., Pittsburgh, is making a study and will submit report on a complete sewage disposal plant. Estimated cost, $200,000. Noted June 1.

Texas

FORT WORTH—The Royal Duke Refining Co., P. O. Box 1400, has purchased a site along the Frisco R. R. and plans to construct a 1 and 2 story, 5000-bbl. oil refinery on same. E. E. Costley, Royal Duke Refining Co., engineer.

VAN ALSTYNE—The city has awarded the contract for the construction of a sewerage system, to include a disposal plant, to the James Contracting Co., Ranger. Estimated cost, $32,000.

Washington

OROVILLE—The Pyarganite Mining Co. plans to construct a 50-ton mill to treat silver ore. Tables and flotation machinery will be needed. Estimated cost, $40,000. Monroe Harmon, manager.

West Virginia

FAIRMONT—The West Virginia Metal Products Co. has awarded the contract for the construction of a brass plant, consisting of an 80x280-ft. casting shop, 280x380-ft. factory and 150 dwellings, to F. T. Ley Co., 495 Main St., Springfield, Mass. Estimated cost, $1,500,000. Noted June 16.

Wisconsin

CUMBERLAND—The city plans to excavate and lay a vitrified pipe sewer, also install a sewage disposal system, on Main St.; system not yet decided, probably gravity flow. Estimated cost, between $25,000 and $30,000.

KOHLER—The Kohler Co., care of W. J. Kohler, has awarded the contract for the construction of a 4-story, 60x250-ft. enamel ware factory, on Main St., to Worden-Allen Co., 208 South La Salle St., Chicago, Ill. Estimated cost, $50,000.

MILWAUKEE—The Chain Belt Co., 736 Park St., has awarded the contract for the construction of a 1-story, 150 x 316-ft. malleable iron foundry on 39th Ave. and Orchard St., to S. M. Siesel, 36 Michigan St. Estimated cost, $200,000.

MILWAUKEE—F. Martin-Laskin Co., Fratney and Keefe Aves., has awarded the contract for the construction of a 2-story, 60 x 140-ft. addition to its tannery to W. F. Tubesing Co., Wauwatosa. Estimated cost, $35,000.

PACKWAUKEE—The Cramer Memorial Institute, 204 Grand Ave., Milwaukee, will soon receive bids for the construction of a 3-story, 40 x 120-ft. sanitarium. A private water system and a septic tank will be installed in same. Estimated cost, $100,000. Backes & Pfaller, M & M Bank Bldg., Milwaukee, architect and engineer.

SHEBOYGAN—The Badger State Tanning Co., South Water St. and Maryland Ave., plans to build a 3-story, 60 x 250-ft. tannery on Water St. Estimated cost, $50,000. Architect not selected.

WAUWATOS—The City Council plans to build a sewage disposal plant. Estimated cost, $30,000. J. E. Lowther, city engineer.

Ontario

BROCKVILLE—The Brockville Paper Manufacturing Co. will soon receive bids for the construction of a factory on Park St. Estimated cost, $60,000.

PETERBOROUGH—The city is having plans prepared for the installation of slow sand filters on the old Carnegie property, capacity about 4,000,000 gal. per day. Estimated cost, $200,000. W. Parsons, City Hall, engineer. Noted Feb. 1.

Coming Meetings and Events

THE AMERICAN IRON AND STEEL INSTITUTE will hold its sixteenth general meeting at the Hotel Commodore, New York, Oct. 24 and 25.

THE SOCIETY OF INDUSTRIAL ENGINEERS will hold its fall convention Oct. 29 to 31 inclusive, at Cleveland, Ohio.

THE SOUTHERN FERTILIZER ASSOCIATION will hold its annual meeting Wednesday, Nov. 5, 1919, at 10 A. M. at Piedmont Hotel, Atlanta, Ga.

FOURTH INDUSTRIAL SAFETY CONGRESS of New York City will be held at the Hotel Onondaga, Syracuse, N. Y., Dec. 1, 2, 3 and 4, 1919.

THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS will hold its annual meeting Dec. 3 to 6 at Savannah, Ga.

Industrial Notes

THE JEFFREY MFG. CO., of Columbus, Ohio, has taken out group life insurance with the Travelers, effective Oct. 25, covering its 2200 employees. The increment of the insurance is $100 a year up to and including the fourth year, when an amount of $800 is attained. For the fifth year the amount jumps to $2000 and then increases $100 per year to $4000. The whole plan is retroactive.

MR. F. C. WORTH, consulting engineer, 309 Monadnock Block Bldg., Chicago, is preparing plans and specifications for two plants in the United States located at the mines, for grinding fuller's earth. It is reported that the product will be fully equal to that which is now being imported from England for bleaching and refining lard, table and mineral oils, and sugar.

THE NATIONAL ASSOCIATION OF PURCHASING AGENTS, in considering arrangements of catalogs, and particularly the confusion regarding the location of the index, has officially recommended that the placing of the index in the back of the book should be made a standard practice. The Association's standardization committeee has recommended a tentative standard form for invoices, checks and vouchers.

THE CHESAPEAKE IRON WORKS, of Baltimore, Md., manufacturer of the Chesapeake electric traveling cranes, has recently announced the opening of its New York office in the Woolworth Bldg. The office will be in charge of Mr. H. L. Mode.

THE AMERICAN CHAMBER OF COMMERCE FOR BRAZIL announces the appointment of Mr. Leslie E. Freeman as resident representative of the Chamber in the United States. Mr. Freeman's office will be at 37 Liberty St., New York City. He extends the benefits of the organization to American manufacturers, exporters and importers in Brazil.

THE EAST IRON & MACHINE CO., Lima, Ohio, has purchased the Van Wie Pump Co., of Syracuse, N. Y., successor to the Baldwinsville Centrifugal Pump Co. The East Iron & Machine Co., at its plant in Lima, will at once begin to manufacture vertical and horizontal centrifugal pumps, double suction pumps, sand pumps, hydraulic dredge pumps, single acting triplex pumps and vertical steam engines, and will also make parts for all Van Wie products.

THE KEMOROID PRODUCTS CO., a corporation whose organization was interrupted in 1917 by the war, has resumed work at 325 W. Madison St., Chicago. The officers and directors of the company are: G. M. Salmon, C. R. Beam, W. H. Harrison, M. G. Rasbach, J. R. Cole, B. D. Burns. This organization is owner of formulae and processes for the manufacture of substitutes and artificial leathers and for waterproofing fabric and papers. The company also expects to manufacture a full line of all grades and finishes, thereby covering the entire field and market for substitute leathers. There is an authorized capitalization of $3,000,000 divided into 300,000 shares of $10 par value. The company claims that the processes and formulae produce an article wherein there is greater adhesion of coating to the fabric base than any other on the market. This is accomplished by the direct application of the film to the fabric base. The company also claims to eliminate the appearance of the web of the fabric base on the filmed side of the finished product, while the most important claim is the retention of thorough pliability under regular ordinary wearing conditions. The film is said to have properties of great tensile strength and toughness. Plans are under way to locate the plant in Louisville, Ky. It is expected that the complete erection of the factory for producting this material will be accomplished in about four months' time.

THE BRITISH AMERICAN CHEMICAL CORPORATION announces the removal of its office from Ridgefield Park, N. J., to 109-111 Beekman St., New York City.

THE SUGAR LAND MFG. CO., Sugar Land, Texas, is enlarging its sulphuric acid plant from 50 tons daily capacity to 100 tons. It has three new concentrators in operation and one under construction, and also two new sulphuric burners. The construction work was planned and is under the direct supervision of Mr. L. D. Lansdale, superintendent of the acid plant.

THE DENVER, BOULDER & WESTERN RAILROAD has been purchased by the Morse Bros. Machinery & Supply Co. of Denver. This road, 49 miles in length, located in Boulder County, connects Ward and Eldora with Boulder, and is the outlet for practically all the mining towns and districts of Boulder County. It is a narrow gage line, laid with 56-lb. rail, and is equipped with 8 locomotives, 90 freight cars, passenger coaches, etc. The Morse Bros. company has offered this road to the mining men and commercial organizations of Boulder County at a price considerably below its scrap value in order that the road may remain and be of service to the community. An earnest effort is being made by these organizations to save the road from being taken up. The cost of the road was considerably over $1,000,000. Permission has been given the owners by the Public Utilities Commission of Colorado to dismantle the road, which will be done at once in case the Boulder organizations and men are not sufficiently interested to save it. The Morse Bros. Machinery & Supply Co. also announces that the Argentine & Grays Peak Railroad is being dismantled. This road starts from Silver Plume, Colo., and goes to the summit of Mt. McClellan, 14,000 ft. elevation above sea level. It was used for 17 miles as a tourist road and also served a few mines at Waldorf. It was equipped with 40-lb. steel and gasoline cars and Shay locomotives. All of the material is being brought to Denver for resale.

THE QUIGLEY FURNACE SPECIALTIES CO., New York City, announces that at the sheet mill of the Mansfield Sheet & Tin Plate Co., Mansfield, Ohio, extensions are being made, comprising six new sheet mills, four of which are being installed. The entire furnace installation in this extension will be powdered coal fired. For this work the Quigley air transport system for distributing powdered coal, together with Quigley powdered coal feed controllers, burners, etc., will be installed.

THE MASSACHUSETTS OIL REFINING CO., INC., of East Braintree, Mass., is erecting a refinery, which when completed will cost about $2,500,000. The refinery is designed to have a capacity of 5,000 bbl. per day, and will run crude oil, which has been purchased from the Island Oil & Transport Corp. under contract, and from this crude oil will be extracted gasoline, kerosene, lubricating oils, and wax. The usual steel storage tanks and stills, with warehouse, garage and office buildings, are being erected. The designers, engineers and contractors for the work are Richmond Levering & Co., Inc., New York City.

MR. J. V. N. DORR of the Dorr Company, New York City, purchased, about two years ago, a picturesque stretch of woodland and an old mill at Westport, Conn. The scope of the work at Westport includes analyses, extended research along various lines and the investigation, development, testing and improvement of industrial, chemical and metallurgical processes. The mill has been entirely remodeled and refitted with an attractive library and conference room, sleeping accommodations for transient business visitors, a completely equipped analytical laboratory, and a testing plant of commercial scale tests along many lines. Surrounding the mill both up and down the two rivers, the Saugatuck and the Aspetuck, is a tract of land consisting of 46 acres, some in meadows and hillsides, some in pond and waterways and the rest in natural woodland. Through the untiring efforts of Mr. Herbert Fox and the generosity of Mr. Dorr, and their co-operation with the Nature Club of Westport, the services of Mr. Wilbur F. Smith, state game warden, were obtained and through him the property was leased by the State for a bird and game reserve and is now protected by State law from all hunting, either shooting or trapping, and is under the jurisdiction of Mr. Smith and under the care of the Nature Club. Mr. Dorr has asked the Nature Club to establish feeding places to put up bird houses. These have all been occupied this past summer, demonstrating clearly that the birds readily accept the offerings of their human friends.

Manufacturers' Catalogs

THE AUSTIN COMPANY, Cleveland, Ohio, calls attention to Catalog No. 9, which briefly outlines its scope of construction and equipment service. It contains cross-sections of the ten Austin standard types of buildings and a description of service to foundry and steel plant owners.

THE UNITED METAL HOSE CO., INC., New York City, has issued Folder 100, and a leaflet, on flexible metal hose for the oil industry.

THE CARRIER ENGINEERING CORP., INC., New York City, has just received from the press an attractive catalog entitled "Weather and the Story of How It Is Manufactured." This 62-page catalog illustrates and describes in an interesting manner its service to many maufacturing establishments in the manufacture of weather—humidification, dehumidification, heating, cooling, purification, ventilation, control of moisture regain, and drying.

THE BAUSCH & LOMB OPTICAL CO., Rochester, N. Y., announces a new illustrated manual and catalog of optical glass which contains treatises on the theory and history of optical glass manufacture, including the story of its pioneer work along this line in America, both before and during the war. This company also has issued recently a comprehensive, well-illustrated catalog on microscopes, which marks the restoration of this line to its normal status, together with several new models and features.

THE CELITE PRODUCTS CO., New York City, has issued a new and interesting bulletin describing in detail standard engineering practices of insulating various types of furnaces, such as annealing, heating, forging, malleable, gun, glass, etc. Copies of this bulletin, B-8-A, will be mailed upon request.

THE WALTER A. ZELNICKER SUPPLY CO., St. Louis, has issued Bull. No. 270, entitled "The Nation's Market Place." This bulletin covers rails, locomotives, machinery for power and industrial plants, contractors' equipment and every kind of pipe, steel piling and tanks. Attention is also called to Bull. No. 266, entitled "Rails." Copies will be sent upon request.